THREE ESSAYS ON HOUSEHOLD BEHAVIOR AND LABOR SUPPLY

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ABSTRACT

The objective of this dissertation is to investigate contemporary issues concerning population aging and low fertility in Korea's economy.

The first chapter examines the impact of intra-household transfers on the labor supply of elderly parents by employing "child's gender" as an exogenous variable which leads to parents' differential lifetime net transfers to children. Parental resource allocation in Korea tends to be greater for sons. However, older parents receive less financial support from grown-up sons than traditionally expected. This might be due to an erosion of the long-standing implicit contract between sons and their parents in Korea. Based on evidence that lifetime net transfers from parents are larger to sons than to daughters, I hypothesize that parents who have sons rather than daughters increase their labor supply to offset this cost. In empirical estimates using the Korean Longitudinal Study of Aging data sets, the results show that parents with sons tend to retire later or increase working hours compared to parents with daughters. This "son effect" is especially profound in cases where the boy is also the first-born child.

The second chapter investigates the effect of a major change, in 2011, in the South Korean childcare leave benefits scheme, on fertility. I use a difference-in-differences analysis, exploiting the fact that the reform which increased the generosity of childcare leave benefits was targeted at higher-wage earners. I use the monthly wages and employment status as measures to define a treatment group and a control group. Education level is also used as a proxy for monthly wages in alternative estimation strategies in determining the labor supply effect. I find that the 2011 reform had positive impacts on conception for the treatment group (higher-wage or higher-

education workers) compared to the control group (lower-wage or lower-education workers). These impacts were substantial in cases of second or higher-order fertility. Consistently, I find that the reform had negative effects on the contraceptive use of the treatment group. The results also show evidence of declining career interruption for the treatment group in post-reform. This effect seems a result of another specific aim of the reform: lowering career interruptions of women after giving birth.

The third chapter examines the effect of health shocks on the affected persons' and their spouse's labor supply using the Korean Longitudinal Study of Aging. Health shocks can cause substantial loss of household income due to an involuntary exit from the labor force as well as through direct medical expenditures. In response to this loss of income, a spouse may increase his or her labor supply to make up for lost income. On the other hand, a spouse may decrease his or her labor supply if health shock strongly requires care-giving for the affected individual. The analysis reveals that health shocks reduce the labor supply for both affected males and females. The results also show that husband's chronic illness increase wife's labor supply. However, a wife's health shocks do not affect a husband's labor supply. The little impact of women's health shocks may be explained by the fact that women's earnings are usually a secondary source of household income in dual-earner couples, so male workers may not be highly sensitive to the economic impact of their partners' health shocks. The results also indicate that having low net assets decreases the probability of exiting the labor force for husbands and increases the probability of entering the labor force for wives in response to spousal health shocks. These imply that a lack of sufficient wealth in a household enhances the "Added Worker Effect" in South Korea.

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CHAPTER 1

ESTIMATING THE EFFECTS OF INTRA-HOUSEHOLD TRANSFERS ON RETIREMENT BEHAVIOR IN SOUTH KOREA

1.1 Introduction

The substantial explicit and implicit costs of raising children often have a sizable effect on the behavior of parents, in terms of such things as the intra-household allocation of time and resources. Although a large volume of literature examines investment of time and resources by parents in their children's development, these studies tend to focus on the behavior of relatively young parents, as the bulk of transfers from parents to children occur when children are young. Nevertheless, children are often also an important source of old-age security for parents, which can in part be considered a grown child's eventual repayment for investment in their education and upbringing (Lillard and Willis, 1997). While there are alternative forms of old-age security such as private savings and the public social security system, many elderly parents still rely on familial transfers from grown-up children for security in old-age. This is especially true in Asia where familial transfers from grown-up children to elderly parents are much more prevalent than in other economies (Lee, Mason, and Park, 2011).

These economic linkages between parents and children are more pronounced between parents and sons than between parents and daughters in Asian countries such as South Korea (henceforth Korea), China, and Taiwan. In these countries, parents allocate more financial resources and time to sons, especially to the eldest son, than to daughters, for reasons having to

do with the socio-economic system, "son preference", or social norms such as implicit exchange motives (Strauss and Thomas, 1995; Black, Devereux, and Salvanes, 2005; Booth and Kee, 2009; Jayachandran and Kuziemko, 2011; Wong, 2013; Barcellos, Carvalho, and Lleras-Muney, 2014; Bu, 2014). Reciprocally, grown-up sons tend to transfer more resources to their elderly parents than grown-up daughters do in these societies (Yang, 1996; Sun, 2002; Lin et al., 2003; Kim, 2010).

Korea presents a unique and noteworthy case with regard to this subject. First and foremost, in Korea, financial transfers from parents to children are often prolonged as parents remain continuously involved in their children's affairs—including education, career, marriage, and even housing—long after the children reach adulthood. Parents often make long-term financial and time commitments with the underlying expectation of future old-age security provided by their eldest son or other sons. This contrasts starkly with other developed countries. Second, Korea's elderly population has the second-highest labor force participation rate among the Organization for Economic Co-operation and Development (OECD) member countries. The labor force participation rate of people 65 years-old or older was 31.3 percent in 2015, while the average for OECD countries was 14.1 percent (OECD, 2017a). Third, in spite of high labor force participation of the elderly, many elderly people earn only small incomes. The poverty rate for those aged 65 or older is also the highest among the OECD member countries, reaching 48.8% percent in 2014 (OECD, 2017b). This might be caused mainly by the National Pension Scheme (NPS) providing no or little entitlement to those who retired before the mid-2000s due to its belated establishment in 1988[1]. Moreover, this particular age group tends to have insufficient

[1] The first disbursement of normal benefit by the NPS was in 2008 and individuals who retired before 2008 received no or substantially reduced pension benefits.

private savings or assets to allow for a comfortable retirement due to significant expenditure on their children's education[2] or housing. Fourth, many parents allocate household resources according to a child's gender. Traditionally, Korean parents had a strong son preference, and tended to allocate more resources for sons than for daughters in terms of child-rearing and bequests, (and which may in part have stemmed from an exchange motive with respect to inter-generational transfers). Lastly, in Korea, men still tend to earn more than women and so are often better able to provide financial support to their parents in return. Also, as a result of the influence of Confucianism, it seems natural that sons be responsible for supporting elderly parents. This relationship might be viewed as an implicit contract between parents and sons. Recently, however, this parents-sons relationship has been diminishing due to rapid declines of traditional familial support systems and substantial improvements in women's socio-economic status.

This study examines the linkage between intra-household transfers and the labor supply of elderly parents by utilizing the 2006-2014 waves of the Korean Longitudinal Study of Aging (KLoSA). Child's gender is utilized as an exogenous variable leading to the difference in the parental lifetime net transfers. Based on evidence that parental lifetime net transfers to sons are larger compared to that apportioned for daughters, this study tests if parents with sons tend to work more in order to make up the income spent. The results show that parents with sons tend to retire later or increase their working hours more than parents with daughters. The results are robust to various specifications, indicating that parents tend to work more when they have sons than when they have daughters. These results suggest that the long-standing implicit contract between sons and their parents is eroding in Korea. Older parents receive less financial support

[2] The education expenditure for children accounts for 14.6 percent of the total household consumption expenditure in 2014 in Korea (Park, 2015).

from grown-up sons than expected although they allocate larger resources to sons. This erosion of the implicit contract may be one reason for an ongoing transition in which son preference is becoming less prevalent. This study contributes to showing the link between intra-household and retirement behavior in the elderly—something that has been paid little attention to in the literature—by using a relatively reliable exogenous variation.

The remainder of this study proceeds as follows. Section 1.2 reviews the previous literature on familial transfers correlated with child's gender. Section 1.3 describes the conceptual framework and the Korean context. Section 1.4 presents the data and empirical methods. Section 1.5 provides the main results and an extension of the analysis. Lastly, the final section concludes with the implications of the study.

1.2 Literature Reviews

A copious amount of literature has attempted to explain the motivation for intergenerational transfers within families. The altruism model argues that intergenerational transfers are induced by altruistic preferences among family members and a larger amount of parental transfers are made to children with fewer lifetime resources (Becker, 1974; Becker and Tomes, 1976). Conversely, the exchange model suggests that intra-family transfers are motivated by the expectation of compensation from the recipient and thus parents tend to make more transfers to children with higher incomes (Bernheim, Shleifer, and Summers, 1985: Cox, 1987; Bernheim, 1991). Lillard and Willis (1997) also suggest the old-age security hypothesis and the parental repayment hypothesis. According to the old-age security hypothesis, parents depend on children's transfers as a means of saving or as assets for old-age security, especially in

developing countries where financial institutions are limited or government social security systems are underdeveloped. Focusing on borrowing rather than savings constraints, the parental repayment hypothesis argues that an implicit contract between parents and children is the underlying reason for parents' investing in the human capital of children and that children repay the investment by providing old-age security for their parents.

Looking at this more closely researchers have empirically examined the influence of the child's gender on parental transfers in developing countries, focusing mainly on parental investment in their children's health and education. In Asian developing countries, the differential allocation of household resources by child's gender is closely associated with son preference (Strauss and Thomas, 1995; Qian, 2008; Jayachandran and Kuziemko, 2011; Wong, 2013; Barcellos et al., 2014). Strauss and Thomas (1995) find that girls in South Asia receive fewer nutritional and health inputs and are disadvantaged in terms of access to education. Jayachandran and Kuziemko (2011) and Barcellos et al. (2014) document the preponderance of boys receiving more childcare time, vitamin supplementation, and breastfeeding compared to girls in India. In the case of China, Qian (2008) finds that an increase in relative female income in a household increases the survival rates for girls, whereas an increase in relative male income decreases the survival rates and educational attainment for girls. On the other hand, Wong (2013) examines whether the allocation of family resources is dependent on the child's gender in the United States and Korea by using the Health and Retirement Study for the US and the KLoSA for Korea. The results indicate that sons receive larger inter-vivos transfers and attain higher levels of education than daughters in Korea, while it's the opposite in the US.

In the US, extensive studies on the role of the child's gender in child-to-parents familial transfers report that American daughters are more likely than sons to provide assistance to their

aging parents (Coward and Dwyer, 1990; Dwyer and Coward, 1991; Stoller, 1990; Shuey and Hardy, 2003). This tendency is reversed in Asian countries such as China, Taiwan, and Korea where sons tend to provide more financial support to their parents (Yang, 1996; Sun, 2002; Lin et al., 2003; Kim, 2010). One study by Xie and Zhu (2009) stands in contrast to the norm in Asia, and shows that in urban China, married daughters provide more financial support to elderly parents than married sons do. They interpret the results as a reflection of the rapid disappearance of the traditional Chinese family model in which sons usually bear more responsibility for supporting elderly parents.

1.3 Backgrounds

1.3.1 Conceptual Framework

To conceptualize the linkage between gender of offspring and parental labor supply, this study considers parents' lifetime budget constraints which are directly related to child's gender as follows:

$$w \cdot L(g,X) + T^{C \to P}(g,X) = C(X) + T^{P \to C}(g,X), \tag{1.1}$$

where w is the wage rate, $L(\cdot)$ is parent's labor supply, $T^{C \to P}(\cdot)$ is the financial transfers from children to a parent, $C(\cdot)$ is parent's consumption, $T^{P \to C}(\cdot)$ is the financial transfers from a parent to children, g is child's gender (one if son; zero if daughter) and X is the set of parent's characteristics. I assume that there is no public sector, no asset income, and no financial transfer to others. The equation (1.1) is rewritten as follows:

$$w \cdot L(g, X) = C(X) + T^{P \to C}(g, X) - T^{C \to P}(g, X), \tag{1.2}$$

or

$$w \cdot L(g, X) = C(X) + NetT^{P \to C}(g, X), \tag{1.3}$$

where $NetT^{P \to C}(\cdot)$ are the net transfers from a parent to children. With the assumption that wage rate is constant (=1), the equation (1.4) can be drawn from the equation (1.3) as follows:

$$L(1, X) - L(0, X) = NetT^{P \to C}(1, X) - NetT^{P \to C}(0, X), \tag{1.4}$$

In the equation (1.4), "if $NetT^{P \to C}(1, X) - NetT^{P \to C}(0, X) > 0$, then $L(1, X) - L(0, X) > 0$" is obtained. In other words, if the parents' lifetime net transfers to children are larger when parents have sons rather than daughters, then the labor supply of that parent increases. An increase in labor supply might be represented by delayed retirement or more working hours. A worker may choose to delay retirement to increase labor supply if their working hours are not flexible. Conversely, if a worker can adjust their working hours, then he or she may choose to increase working hours instead of delaying retirement. Thus, this study considers these two possibilities in examining the labor supply response.

On the other hand, accurately estimating differences between parents' lifetime net transfers to sons and daughters (i.e. $NetT^{P \to C}(1, X) - NetT^{P \to C}(0, X)$) is problematic. To do this would really require comprehensive data sets which contain all lifetime transactions between a parent and child. As such comprehensive data sets are difficult—or impossible—to obtain, I look at various surveys, statistics or related studies that enable us to reasonably determine the sign of the "$NetT^{P \to C}(1, X) - NetT^{P \to C}(0, X)$" in the following subsections.

1.3.2 Differences between Parental Transfers to Sons and Daughters in Korea

Until recently, son preference persisted in Korea. The sex ratio at birth initially widened following the introduction of ultrasound technology in the 1980s. It reached a peak of 116 boys to 100 girls in 1990. However, the development of the Korean economy and the improvement of women's socio-economic status led to its level to a natural level of 105 boys to 100 girls in 2014. As for the motive for son preference, researchers often emphasize the influence of social institutions and cultural norms such as the son's traditional role in caring for elderly parents, patriarchy, and male-preference primogeniture (Das Gupta et al., 2003; Chung and Gupta, 2007). Many studies find differential allocations of household resources in health or education investment between sons and daughters in countries where son preference is observed (Strauss and Thomas, 1995; Qian, 2008; Jayachandran and Kuziemko, 2011; Wong, 2013; Barcellos et al., 2014). The differential parental investment between sons and daughters influenced by son preference might be explained by the exchange model in inter-generational transfers. The higher market status of men in developing countries makes sons more appealing to parents as a potential source of old-age support.

Under the influence of son preference or the implicit contract between parents and sons, there may be various boy-girl differences in parental net transfers to their children in Korea. Among them, this study focuses on three areas considered especially significant: (1) investment in children's education; (2) support for children's marriage expenses; (3) income transfers from grown-up children to elderly parents. This study analyzes the behavior of parents born mainly in the 1940s to 1950s and their children born mainly in the 1970s to 1980s. Based on this time frame, I reasonably assume that these children enrolled in secondary and tertiary school in the 1980s to 1990s, married in the mid-1990s to mid-2010s, and begun income transfers to elderly

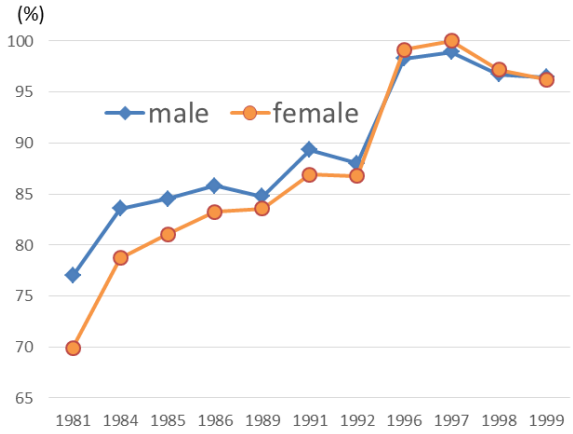
parents in the 2000s to 2010s. By analyzing the behavior of these age groups, this study highlights the differences in parental net transfers to sons and daughters.

Parental Investment in Children's Education

Korean parents are generally very devoted and willing to allocate an enormous amount of their income toward their children's education. Hence, the cost of education for their children is often parents' main economic burden in raising children. Once children are enrolled in school, parents often spend a considerable amount of money for tuition, textbooks, private tutoring[3], and even lodging. Thus, it is possible to deduce the role of a child's gender in education investment made by parents by looking at the difference in school enrollment rates along gender lines. Panel A of Figure 1.1 illustrates the secondary school enrollment rate in the 1980s to 1990s. It shows that

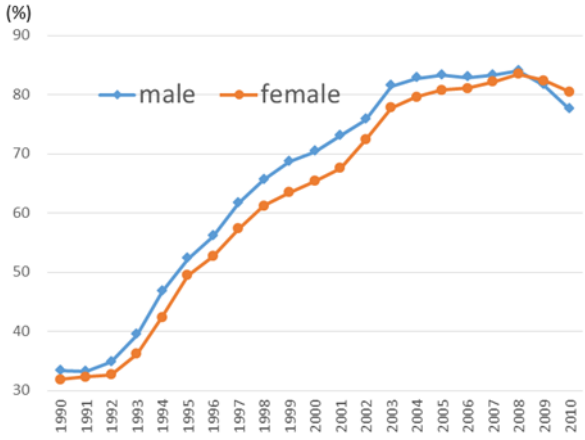
Figure 1.1. School Enrollment Rates in Korea

Panel A. Secondary School



Source: World Development Indicators (http://databank.worldbank.org/data/).

Panel B. Tertiary School



Source: Ministry of Education, Republic of Korea and Korean Educational Development Institute, *Statistical Yearbook of Education* (http://kess.kedi.re.kr/index).

[3] In Korea, the expenditure on private tutoring is an important form of parental investment in children's education (Lee and Lee, 2015).

secondary school enrollment rate for boys was higher than girls in the 1980s[4]. In the 1990s, the tertiary school enrollment rate for men was higher than women while the secondary school enrollment rate was similar between them. Based on these statistics, it is evident that the educational investment in sons was, on average, higher compared to daughters in the given period of analysis.

Support for Children's Marriage Expenses

Several studies have investigated gender differential in marriage expenses and financial obligation borne by family, especially in the Chinese context. They show that a groom's family often pays a "bride price" that exceeds the value of a dowry (Brown, Bulte, and Zhang, 2011; Wei and Zhang, 2011; Zhang, 2000). Wei and Zhang (2011) find that groom's families need to save money over a longer period time than the families of brides—often for a few years before and after the wedding—and tend to pay for the majority of wedding costs. They also show that a groom's family is mainly responsible for procuring a house for the newlyweds, which is becoming a significant burden for a groom's parents (Wei and Zhang, 2011; Zhang, 2000). A similar marriage tradition is also observable in Korea. Korean marriages require a huge amount of money, typically for housing, fixtures, wedding ceremony, honeymoon, and gift exchanges. The heaviest monetary burden is often the cost of a house for the newlyweds. Though a large number of newly married couples rent a house instead of buying one, the cost of housing is still a burden due to Korea's unique rental system called "Jeonse[5]" which requires a big lump-sum

[4] Secondary school was not mandatory during this time since compulsory education in secondary school was introduced fully in 2004 in Korea.

[5] Jeonse requires tenants to make a deposit of approximately two-thirds of the property price for key money, which is then refunded once the lease expires. The tenant pays no monthly rent for the duration of the contract, which typically lasts for two years. Jeonse was traditionally much more popular than a monthly payment system until recently.

deposit to start. In Korean society, the burden of marriage expenses is usually heavier for men than for women since men are traditionally responsible for procuring a house upon marriage. Newlyweds tend to depend on their parents to finance wedding expenditures, and many parents also tend to regard these expenses as a duty. As a result, the parents of a groom bear a heavier burden of support for marriage expenses than the bride's parents.

Several surveys and studies make note of the monetary burden arising from these marriage traditions. As can be seen in Table 1.1, Kim et al. (1994) reports that the average cost of housing at marriage was $38,600 (in 1993 USD); the groom's parents accounted for 47.4 percent of the housing cost on average, while 10.4 percent was financed by the bride's parents. A 2012 survey conducted on marriages from 2010 to 2012 by the Ministry of Health and Welfare and the Korea Institute for Health and Social Affairs (KIHASA) illustrates the cost of marriage in recent years (Table 1.2). The groom's side spent an average of $112,000 (in 2012 USD) for marriage, and around 40 percent of the total marriage cost was financed by others (i.e. his parents). As for the bride's side, the cost of marriage was $33,700 (in 2012 USD) with almost half of the cost defrayed by others. In the same survey, 75 percent of male respondents replied that housing cost was the heaviest burden of marriage. Lee (2011) shows that a groom's financial share in marriage expenditure is approximately 80 to 90 percent for all age groups, suggesting that the Korean tradition of the groom's family footing the majority of housing costs for newlyweds is still prevalent (Table 1.3). These surveys and studies confirm that parents' financial support for their children's marriages is much higher for sons than for daughters primarily due to the understanding that parents of a groom are responsible for housing costs for their newlywed children.

Table 1.1. Housing Expense at Marriage in 1993

Housing expense	From groom's parents	From bride's parents
$38,600	47.4%	10.4%

Note: price in 1993, Korean won is converted into dollar terms using OECD PPP exchange rates (645.2 Korean won=1 dollar, 1993).
Source: Kim et al. (1994).

Table 1.2. Marriage Expenses in 2012: Including Housing Expenses

	Marriage expenses	From parents
Groom	$112,000	42.7%
Bride	$33,700	47.2%

Note: price in 2012, Korean won is converted into dollar terms using OECD PPP exchange rates (854.9 Korean won=1 dollar, 2012).
Source: National Survey on Marriage and Fertility Dynamics (Kim et al., 2012).

Table 1.3. Shares in Housing Expenses at Marriage

Age group	20's-30's	40's-50's	60's
Groom	86.5%	78.3%	93.8%
Bride	13.5%	21.7%	6.2%

Source: Lee (2011).

Financial Transfers from Children to Elderly Parents

In Confucian-influenced countries such as Korea, inter-generational transfers in a household occur not only in a downward direction but also in an upward direction as grown-up children support their retired parents. Among grown-up children, sons (especially the eldest) have traditionally taken greater responsibility than daughters in supporting parents. Given this traditional sons-parents economic relationship, elderly parents with sons are usually supported better financially.

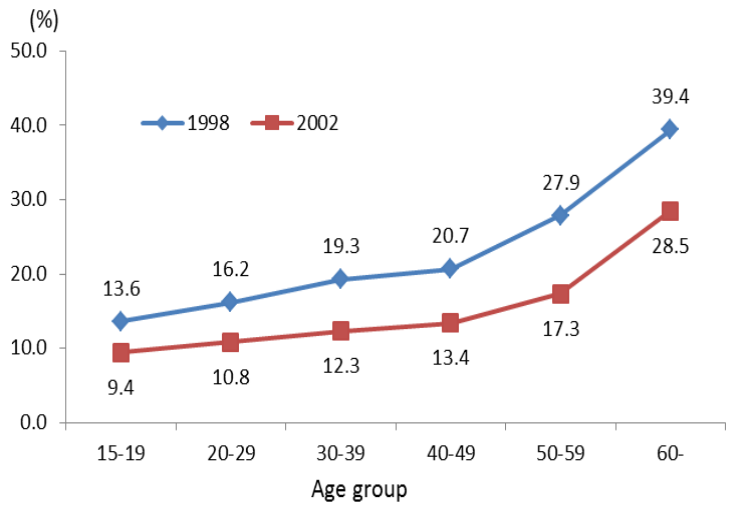
Few relevant studies on this reciprocal and gender-dependent inter-generational transfer are available. Kim (2010) may be the only Korean study that examines how the gender of offspring affects financial transfers from grown-up children to aging parents[6]. Using data from the KLoSA, the author finds that grown-up sons provide more net financial support to their elderly parents than daughters by $260 (in 2005 USD) per year in 2005. However, the value of this annual difference is small compared to the overall impact of child's gender on disproportionate parental support for education and marriage.

A possible explanation for the relatively minor difference between sons and daughters in direct financial support for elderly parents is the fading of Confucian traditions in the lives of the younger generation. Many grown-up children do not seem to feel that sons should be the main providers of old-age security for their parents. However, elderly parents still tend to expect more support from sons than daughters after retirement. The results of surveys conducted by the Korean government further support these ideas well. The survey asks, "Who should mainly be responsible for supporting elderly parents?" Figure 1.2 illustrates the percentage of people who believe that the eldest son should care for elderly parents in 1998 and 2002, respectively. The survey results show that only a small percentage of the younger generation thinks that the eldest son should support his elderly parents and this number is shrinking over time, whereas a substantial percentage of the older generation still think that the eldest son should provide old-age security. A 1990 revision of the civil law on inheritance may also be weakening sons' motivation to support their elderly parents. Before the revision of the law, the eldest son inherited most of his parents' wealth, and younger sons still inherited more than daughters.

[6] In this study, children are defined as adults aged 19 or over who do not live with their parents and are not students during the time of the survey. The average age of parents is 69.5 and that of their children is 41.5.

However, since the revision, all children have been entitled to equal inheritance regardless of their gender or birth order. Additionally, the improvement of the socio-economic status of women could be important. Several studies argue that an increase in women's earnings enhances women's relative bargaining power in intra-household resource allocation (Manser and Brown, 1980; McElroy and Horney, 1981; Hoddinott and Haddad, 1995; Thomas, 1990; Chau et al., 2007). The enhanced bargaining power of women may increase daughters' financial transfers to their own elderly parents instead of their parents-in-law, according to their preference.

Figure 1.2. Percentages of People Who Believe the Eldest Son Should Care for Elderly Parents



Note: The figure displays the percentage of people by age, who responded, "the eldest son," to the question, "Who should mainly be responsible for supporting elderly parents?"
Source: Statistics Korea, Republic of Korea, *Social Survey* (http://kosis.kr/).

1.3.3 Hypothesis

The evidence presented above suggests that parental lifetime net transfers to children are, on average, greater when parents have sons rather than daughters. The discrepancy largely results from the fact that parents transfer more income to sons for education and marriage, than to daughters, while the gender difference in income transfers from children to parents for old-age security is negligible. Due to an erosion of the implicit contract traditionally maintained between

parents and sons, elderly parents come to receive less financial support than might originally have been expected from their grown-up sons. Based on these findings, this study hypothesizes that parents with sons rather than daughters increase their labor supply to offset their spending. The following sections test this hypothesis using several estimation methods.

1.4 Data and Estimation Methods

1.4.1 Data

To test the effect of the child's gender on the labor supply of parents, I primarily use the fifth wave of the KLoSA, which was conducted in 2014. The first to fourth waves of the KLoSA are also used as supplements in order to collect job history data, such as the employment status of the recent job and the year of retirement. The KLoSA is a biennial survey that began in 2006 for creating the basic data needed to devise and implement effective social and economic policies to manage an aging population. It interviewed 10,254 individuals (aged 45 or older) in 2006 and contains a relatively large sample size of older workers in Korea. Topics covered include demography, family, health, employment, income, assets, and subjective expectations and satisfactions. The fifth wave had 7,029 respondents (2,987 males and 4,042 females) as some respondents had been dropped since the first wave or did not respond. I restrict the samples to retirees or workers as of the interview date in 2014, excluding those who have never had a job before, or those who have the intention to work, but do not work currently. In this study, I adopt the definition of retirement employed by the KLoSA, which is (1) having stopped doing income-earning activities, (2) presently not working or engaging only in pastime work, and (3) having no intention of engaging in anything more serious than pastime work as long as there is no special

change in circumstances. The final sample consists of 4,375 individuals (2,596 males and 1,779 females).

Identifying the birth years of parents and children is essential in examining the impact of the gender of offspring on the parents' labor supply because the trend of gender difference in offspring affecting parents' lifetime net transfers to children may change over time. As shown in Table 1.4, the mean birth year for parents is 1947 (S.D. 9.28) for the males and 1949 (S.D. 9.01) for the females, and the mean birth year of the children is 1978 (S.D. 9.37) for the males and 1977 (S.D. 9.26) for the females.

Table 1.4. Year of Birth in the Samples

	Male		Female	
	Mean	S.D.	Mean	S.D.
Year of Birth (Respondent)	1947	9.28	1949	9.01
Children's Year of Birth	1978	9.37	1977	9.26

Note: Calculated by the author using the KLoSA data.

Table 1.5 reports the mean and standard deviation of the variables used in the analysis. In the selected samples, 41 percent of male workers with the mean age of 67 were retired in 2014 and 38 percent of female workers with the mean age of 65 were retired in 2014. The mean retirement year is 2003 for both male and female retirees. They have 2.8 children on average for male respondents, and 2.9 for female respondents and the ratio of sons to children in a household is slightly more than half. The average age of the youngest child is 35 for the male samples (36 for the female samples), and 69.2% of the total children were married in 2014. Both education level and public pension enrollment rate of the males are higher compared with the females. It reflects the higher socio-economic position of males in Korean older generation.

Table 1.5. Summary Statistics

	Male		Female	
	Mean	S.D.	Mean	S.D.
Work status (0=working, 1= retired)	0.41	0.49	0.38	0.49
Weekly working hours (if working)	44.03	15.60	39.76	17.53
Retirement year (if retired)	2003	9.19	2003	10.25
Age	67.48	9.28	65.22	9.01
Ratio of sons to children	0.52	0.29	0.52	0.29
Number of children	2.82	1.25	2.95	1.37
Age of the youngest child	35.14	8.67	36.42	8.49
Education (1=high school or more)	0.56	0.50	0.30	0.46
Health status (1=bad)	0.30	0.46	0.33	0.47
Employment status (1=self-employed)[a]	0.47	0.50	0.49	0.50
Place of residence (1=rural)	0.25	0.43	0.31	0.46
Household net assets (USD)[b]	316,885	391,724	258,666	346,414
Observations	2,596		1,779	

Note: Calculated by the author using the KLoSA data.
[a] For retirees, it is measured by the employment status of most recent job.
[b] Korean won is converted into dollar terms using OECD PPP exchange rates (870 Korean won=1 dollar, 2014).

1.4.2 Estimation Methods

In order to test the hypothesis that parents with sons increase their labor supply compared to parents with daughters, the following equation is basically estimated:

$$y_i = \beta_0 + \beta_1 chgender_i + \beta_X X_i + \varepsilon_i , \quad (1.5)$$

where y_i is the labor supply of individual *i*, $chgender_i$ is the gender of *i*'s child, X_i is a set of *i*'s characteristics likely to affect his/her labor supply.

To examine the effect of the child's gender on labor supply comprehensively, three types of dependent variables are constructed in this study: (1) binary variable for retirement (zero if working; one if retired); (2) respondent's age at retirement; (3) weekly working hours (censored at 0). Method (1) and (3) enable us to estimate the impact of the child's gender on retirees and workers, while method (2) captures the impact on retirees only. As for the independent variable, measuring "child's gender" can be an issue when a respondent has both sons and daughters. This study measures "child's gender" in the following three ways: (1) the ratio of sons to total number of children, controlling for the total number of children; (2) the variables for both the number of sons and the number of daughters which are included in the estimation models simultaneously; (3) the dummies for the gender of each child, controlling for the total number of children.

On the other hand, sibling sex-composition in a household cannot always be treated as an exogenous variable due to the technology of sex-selective abortion. Several studies find that having access to such technology significantly increases the number of sex-selective abortion incidents (Kim, 2005; Chen, Li, and Meng, 2013). However, this is not likely to be a problem for the purposes of this study as it mainly focuses on children who were born before the diffusion of ultrasound technology[7]. Additionally, the gender of the first-born child may affect parents' decision-making in whether or not to have an additional child if parents have a strong preference for a certain kind of child's gender (Gupta, 1987; Raju and Bhat, 1995; Arnold, 1997). This may

[7] In Korea, sex selection technologies such as ultrasonic tests were introduced in the early 1980s and were widely diffused by the late 1980s (Lee and Lee, 2015).

not also be problematic in this study because parents' preference for child's gender is not likely to be much systematically correlated with their retirement behavior later in their life-cycle.

1.5 Results

1.5.1 Impact on the Probability of Retirement

As the first estimation method, this study uses probit models to capture the effect of the child's gender on parents' retirement behavior. The probit models are derived from a latent variable model as shown in equation (1.6). Assume that r_i^* is the unobserved propensity to retire given by the probit index function for individual *i* by:

$$r_i^* = \beta_0 + \beta_1 chgender_i + \beta_X X_i, \tag{1.6}$$

where $chgender_i$ is the child's gender of *i,* and X_i is a set of individual's characteristics. The binary outcome variable for whether the worker retires is:

$$R_i = \begin{bmatrix} 1 \;\; if \;\; r_i^* > 0 \\ 0 \;\; if \;\; r_i^* \le 0 \end{bmatrix}, \tag{1.7}$$

Table 1.6 presents the probit estimates of equation (1.6) and (1.7) using the ratio of sons to the number of total children as the key independent variable. The first specification includes only the number of total children and parent's age as the other explanatory variables, while the second specification additionally includes dummies for education, marital status, employment status, spouse's work status, health status, and residence, the age of the youngest child, and logged household net assets.

Column (1) and (2) of Table 1.6 show the probit estimates of the first specification of males and females. The results indicate that the probability of retirement is reduced by 11.5 percentage points for males and 8.5 percentage points for females when all children are sons rather than daughters. When other individual's characteristics are used to control any bias associated with individual preferences for leisure in Column (3) and (4), the "son effect" is still present although the magnitude and significance are slightly reduced for both males and females. The coefficient of the ratio of sons in Column (3) indicates that when the gender of all children is male, it leads to a 9.8 percentage point decrease in the probability of retirement in male parents; this effect is statistically significant at the 1% level. Given that the average probability of men's retirement of 40.9 percent from Table 1.5, this suggests an increase in the retirement rate by 24.0 percent. Column (4) reports the probit results for females. If all children are sons, it reduces the probability of retirement of the females by 7.1 percentage points (p-value = 0.094). This effect is also not small relative to the average probability of female retirement at 38.3 percent.

As shown in Column (3) and (4) of Table 1.6, when other explanatory variables such as education, health status, and employment status are added, the effect of the number of children falls substantially for both males and females. Especially, the employment status (1=self-employed) and the place of residence (1=rural area) are attributable to this decrease because these two variables are positively correlated with the number of children. It suggests that people who live in rural areas and are self-employed tend to have more children. The number of children is also negatively correlated with the ratio of sons (correlation coefficient: -0.229). The relationships between these variables suggest that an individual's other characteristics, which are included in Column (3) and (4), should be controlled for to estimate the effect of the gender of offspring appropriately.

Table 1.6. Probit Estimations: Son Ratio (Dependent Variable: 0=Working; 1= Retired)

	(1) Male	(2) Female	(3) Male	(4) Female
Ratio of sons	-0.115***	-0.085**	-0.098***	-0.071*
	(0.035)	(0.041)	(0.037)	(0.042)
Number of children	-0.059***	-0.054***	-0.017	-0.018
	(0.011)	(0.012)	(0.012)	(0.013)
Age	0.039***	0.029***	0.034***	0.023***
	(0.002)	(0.002)	(0.003)	(0.003)
Education (1=high school or more)			0.066***	0.055*
			(0.025)	(0.033)
Health status (1=bad)			0.229***	0.169***
			(0.026)	(0.028)
Employment status (1=self-employed)			-0.268***	-0.106***
			(0.024)	(0.028)
Place of residence (1=rural)			-0.192***	-0.216***
			(0.030)	(0.032)
Age of the youngest child			0.007**	0.005
			(0.003)	(0.003)
Other characteristics[a]	No	No	Yes	Yes
Obs.	2,596	1,779	2,596	1,779

Notes: Marginal effects at means are reported. Robust standard errors in parentheses. *, **, and *** indicate statistical significance at the 10, 5, and 1 percent level, respectively.
[a] Dummies for marital status and spouse's work status, and logged household net assets.

I also use probit retirement models in estimations by including the variables for the number of sons and the number of daughters instead of the ratio of sons and the number of children. Table 1.7 reports the probit estimation results. As can be seen in Column (1) of Table 1.7, the results indicate that an increase by one in the number of sons lowers the probability of retirement by 3.4 percentage points for males while the number of daughters has little effect; the estimates on the number of sons is statistically significant at the 5% level. Similarly, for the females, having an additional son reduces the probability of retirement by 3.4 percentage points

Table 1.7. Probit Estimations: Number of Sons (Dependent Variable: 0=Working; 1= Retired)

	(1) Male	(2) Female
Number of sons	-0.034**	-0.034*
	(0.016)	(0.018)
Number of daughters	-0.002	-0.005
	(0.012)	(0.013)
Age	0.034***	0.024***
	(0.003)	(0.003)
Education (1=high school or more)	0.065***	0.055*
	(0.025)	(0.033)
Health status (1=bad)	0.228***	0.169***
	(0.026)	(0.028)
Employment status (1=self-employed)	-0.267***	-0.106***
	(0.024)	(0.028)
Place of residence (1=rural)	-0.192***	-0.214***
	(0.030)	(0.032)
Age of the youngest child	0.007**	0.005
	(0.003)	(0.003)
Other characteristics[a]	Yes	Yes
Obs.	2,596	1,779

Notes: Marginal effects at means are reported. Robust standard errors in parentheses. *, **, and *** indicate statistical significance at the 10, 5, and 1 percent level, respectively.
[a] Dummies for marital status, spouse's work status, and residence, and logged household net assets.

(*p*-value = 0.054) while the number of daughters has almost no effect. The results imply that elderly parents' labor supply positively increases in response to sons, but does not increase in response to daughters. These effects are consistent with the results of previous estimations which suggest the ratio of sons to the number of children reduces the probability of parents' retirement.

To test whether the "son effect" on parents' retirement is heterogeneous according to child birth order, dummies for the gender of each child are included with a dummy for the number of children controlled for in the estimation model. Although an extensive literature has explored the birth order effect on children's education or health in developed countries, conclusions are mixed (Hauser and Sewell, 1985; Kessler, 1991; Black et al., 2005; Wang et al., 2007, Booth and Kee, 2009; Bu, 2014; Lundborg, Nilsson, and Rooth, 2014). Regarding this issue, several studies propose the causal mechanism of the birth order effect including time constraints, disciplinary restrictions, or endowment effect (Price, 2008; Hotz and Pantano, 2015; Black et al., 2005). On the other hand, in some developing countries where son preference prevails, the eldest son may receive more investment from parents because economic linkages between parents and children were traditionally stronger with the eldest son. However, if the implicit contract between parents and the eldest son are eroding, parents with a first-born child who is male are likely to retire later relative to other parents.

Table 1.8 reports the estimated influence of male offspring on the probability of parents' retirement reflecting child birth order. For both male and female workers, the effect due to child's gender is established in the case of the first child. If the first-born child is male, it leads to a 4.1 percentage point decrease in the probability of retirement for fathers, and a 4.9 percentage point decrease for mothers; the estimates of the impact of the first child's gender is statistically significant at the 10% level for both male and female workers. In contrast, no child gender effect is found in the second or higher birth orders. These results likely reflect the fact that parents invested more household resources especially in the first-born male child than other children, but this son may support elderly parents less robustly than might traditionally have been expected.

Table 1.8. Probit Estimations: Gender Effects by Birth Order (Dependent Variable: 0=Working; 1=Retired)

	(1) Male	(2) Female
1ST child's gender (1 if son, 0 otherwise)	-0.041* (0.023)	-0.049* (0.026)
2nd child's gender (1 if son, 0 otherwise)	-0.012 (0.025)	-0.002 (0.027)
3rd child's gender (1 if son, 0 otherwise)	-0.046 (0.033)	-0.016 (0.035)
4th child's gender (1 if son, 0 otherwise)	-0.036 (0.048)	0.010 (0.048)
5th child's gender (1 if son, 0 otherwise)	-0.088 (0.073)	-0.091 (0.068)
Age	0.034*** (0.003)	0.024*** (0.003)
Education (1=high school or more)	0.069*** (0.025)	0.055 (0.033)
Health status (1=bad)	0.229*** (0.026)	0.173*** (0.028)
Employment status (1=self-employed)	-0.268*** (0.025)	-0.109*** (0.028)
Place of residence (1=rural)	-0.190*** (0.030)	-0.211*** (0.032)
Age of the youngest child	0.007** (0.003)	0.005* (0.003)
Other characteristics[a]	Yes	Yes
Obs.	2,596	1,779

Notes: Marginal effects at means are reported. The effects of the 6th or over child gender are omitted. Robust standard errors in parentheses. *, **, and *** indicate statistical significance at the 10, 5, and 1 percent level, respectively.

[a] Dummies for the number of children, marital status, employment status, spouse's working, and residence, and logged household net assets.

1.5.2 Impact on Working Hours

Workers may choose to increase their labor supply by increasing their working hours instead of postponing retirement if they cannot adjust retirement age easily. Thus, weekly working hours are utilized as another dependent variable in estimating the effect of the gender of offspring on labor supply. In this context, I employ a tobit model censored at zero; the retirees' weekly working hours is zero. The variable h^* is a latent variable for weekly working hours, which is given by the following function for individual *i* by:

$$h_i^* = \beta_0 + \beta_1 chgender_i + \beta_X X_i, \quad H_i = \max(0, h_i^*), \tag{1.8}$$

where $chgender_i$ and X_i are defined the same as those in equation (1.6) and H_i denotes the observed weekly working hours. Exclusion of the samples without the variable for weekly working hours leaves 4,349 samples (2,589 males and 1,760 females) in the collection. In the samples, average weekly working hours are 44.0 and 39.8 for male and female workers in 2014, respectively.

Table 1.9 reports the results of the tobit estimation. The results show that male workers tend to work more by an average of 5.0 hours per week when all children are sons; this is statistically significant at the 5% level. Considering males' average weekly working hours of 44.0, this result implies that a father's weekly working hours increase by 11.3 percent if all children are sons. The magnitude of the coefficient for females is similar. Table 1.10 reports the tobit estimates of another specification in which the variables for the number of sons and the number of daughters are used. The results find that an additional son increases weekly working hours of the fathers by 1.8 hours (*p*-value = 0.044); it implies that one additional son leads to an increase in weekly hours worked by 4.1 percent. However, the number of daughters has a much

Table 1.9. Tobit Estimations: Son Ratio (Dependent Variable: Weekly Working Hours)

	(1) Male	(2) Female
Ratio of sons	4.983**	5.318**
	(2.016)	(2.612)
Number of children	1.090	1.558*
	(0.751)	(0.886)
Age	-2.267***	-1.980***
	(0.176)	(0.211)
Education (1=high school or more)	-4.041***	-0.910
	(1.633)	(1.996)
Health status (1=bad)	-14.602***	-10.527***
	(1.633)	(1.926)
Employment status (1=self-employed)	16.686***	11.217***
	(1.298)	(1.693)
Place of residence (1=rural)	9.792***	11.440***
	(1.537)	(1.876)
Age of the youngest child	-0.335**	-0.161
	(0.159)	(0.190)
Other characteristics[a]	Yes	Yes
Obs.	2,589	1,760

Notes: Robust standard errors in parentheses. *, **, and *** indicate statistical significance at the 10, 5, and 1 percent level, respectively.
[a] Dummies for marital status, spouse's work status, and residence, and logged household net assets.

smaller effect (0.3 hours) and is not statistically significant (p-value = 0.661). For women, having an additional son leads to an increase of 2.7 hours (6.8 percent) in weekly hours worked, while the effect of an additional daughter is not significant (p-value = 0.478). Regarding child birth order, the effect of a first-born male child eldest son is present for females, but not for males. However, these results are not reported due to the lack of reliability.

Table 1.10. Tobit Estimations: Number of Sons (Dependent Variable: Weekly Working Hours)

	(1) Male	(2) Female
Number of sons	1.816**	2.673**
	(0.936)	(1.164)
Number of daughters	0.312	0.632
	(0.782)	(0.890)
Age	-2.280***	-1.994***
	(0.176)	(0.210)
Education (1=high school or more)	-4.020***	-0.937
	(1.421)	(1.996)
Health status (1=bad)	-14.618***	-10.539***
	(1.633)	(1.927)
Employment status (1=self-employed)	16.745***	11.214***
	(1.297)	(1.694)
Place of Residence (1=rural)	9.792***	11.351***
	(1.542)	(1.878)
Age of the youngest child	-0.324**	-0.160
	(0.159)	(0.191)
Other characteristics[a]	Yes	Yes
Obs.	2,589	1,760

Notes: Robust standard errors in parentheses. *, **, and *** indicate statistical significance at the 10, 5, and 1 percent level, respectively.
[a] Dummies for marital status, spouse's work status, and residence, and logged household net assets.

1.5.3 Impact on Age at Retirement

Whereas the previous two subsections analyze the effect of the child's gender on both retired and working parents, this section estimates the effect on retired parents by using parents' age at retirement as an alternative dependent variable with the OLS estimation model as follows:

$$Age_i = \beta_0 + \beta_1 chgender_i + \beta_X X_i + \varepsilon_i , \tag{1.8}$$

where Age_i denotes the respondent's age at retirement, X_i denotes a set of characteristics including dummies for education, marital status, spouse's working condition, employment status,

occupation, gender, and birth cohort[8], logged labor income, and the age gap between parent and the youngest child. All variables are measured at the time of retirement. The number of observations are 2,310 (1,338 males; 972 females), and the mean age at retirement is 60.2 (62.3 for the males; 57.2 for the females).

Table 1.11 shows the results of the OLS estimation. In column (1), the result indicates that the parent's age at retirement increases by around 1.5 years when all children are sons rather than daughters; this effect is statistically significant at the 5% level. Given that the average retirement age is 60.2, the result implies an increase of 2.5 percent in retirement age. Column (2) in Table 1.11 shows the retirement age of a parent increases depending on the number of sons, but not the number of daughters. The results indicate that an additional son causes his parent to delay retirement by nearly 0.7 years (p-value=0.001). By contrast, the effect of the number of daughters (0.2 years) is substantially less and is statistically insignificant.

The "son effect" depending on birth order is also estimated, and the results are shown in column (3) of Table 1.11. The results suggest that if the first-born child is a son, then a working parent tends to delay retirement by 0.7 years compared to when the first-born child is a daughter. This effect is statistically significant at the 5% level. Similarly, having a second son leads to an increase of the retirement age of a parent by 0.6 years though this is only marginally significant (p-value is 0.107). This "son effect" decreases gradually with the later position in birth order. The results of all specifications in this subsection are consistent with the previous results drawn from models estimating the impact of the gender of offspring on the probability of retirement and weekly working hours.

[8] Dummies for birth cohorts include all respondents who born in the ten-year interval.

Table 1.11. OLS Estimations (Dependent Variable: Age at Retirement)

	(1)	(2)	(3)[b]
Ratio of sons	1.474**		
	(0.577)		
Number of sons		0.673***	
		(0.198)	
Number of daughters		0.201	
		(0.165)	
1st child's gender (1 if son, 0 otherwise)			0.711**
			(0.356)
2nd child's gender (1 if son, 0 otherwise)			0.591†
			(0.366)
3rd child's gender (1 if son, 0 otherwise)			0.521
			(0.423)
4th child's gender (1 if son, 0 otherwise)			0.185
			(0.577)
5th child's gender (1 if son, 0 otherwise)			-0.225
			(0.833)
Number of children	0.426***		Dummies
	(0.153)		Included
Gender (1=male)	4.278***	4.296***	4.267***
	(0.441)	(0.441)	(0.443)
Education (1=high school or more)	-0.700*	-0.699*	-0.770*
	(0.401)	(0.401)	(0.405)
Employment status (1=self-employed)	1.697***	1.703***	1.679***
	(0.408)	(0.408)	(0.411)
Age gap between parent & youngest child	0.140***	0.140***	0.142***
	(0.042)	(0.042)	(0.042)
Other characteristics[a]	Yes	Yes	Yes
Obs.	2,310	2,310	2,310
Adj. R-sq	0.406	0.406	0.409

Notes: Robust standard errors in parentheses. †, *, **, and *** indicate statistical significance at the 15, 10, 5, and 1 percent level, respectively.

[a] Dummies for public pension enrollment, occupation, marital status, spouse's work status, and birth cohort, and logged labor income; All variables are measured at the time of retirement.

[b] The effects of the 6th or over child gender are omitted.

1.6 Conclusions

This study examines the relationship between intra-household transfers and the labor supply of older parents in Korea by using "child's gender" as an exogenous variable which leads to parents' differential lifetime net transfers to children. Based on evidence that parental lifetime net transfers to sons are larger compared to that to daughters, this study tests if parents with sons tend to work more in order to fund these higher transfers. The following four results are obtained from various estimation models. First, having sons decreases the probability of parents' retirement, relative to daughters. Second, parents who have sons tend to increase their working hours compared to those who have daughters. Third, the retirement age of parents is greater when parents have sons rather than daughters. Fourth, this "son effect" is substantial in the case of first-born male children. These results support the argument that having sons increases the labor supply of elderly parents in Korea, relative to daughters. This study argues that a possible mechanism for the differential labor supply of elderly parents according to the gender of offspring is the difference in parents' lifetime net transfer to children between sons and daughters. Because parents' lifetime net transfer to sons is on average larger than to daughters, parents with sons may increase their labor supply to make up for income expended in order to maintain consumption levels after retirement.

The "son effect" on the labor supply of elderly parents in Korea may be a unique phenomenon occurring in the transition period. Due to son preference or an implicit contract between parents and sons, parents traditionally allocate more household resources to sons than to daughters. However, in this transition period, elderly parents may not be supported by grown-up sons after retirement as much as parents might have expected due to the declining strength of familial support systems where sons typically played a key role in supporting their parents, as

well as the substantial improvement in women's socio-economic status in Korea, which increases the bargaining power of women in the household. Working in old age does not always generate disutility. The involuntary labor supply resulting from an unexpected income loss can, however, mean serious distresses to an individual's welfare. If there is an excess supply of elderly labor in the labor market, this may make the matter worse. Accordingly, the results of this study have some noteworthy implications for countries like Korea experiencing significant old-age poverty in conjunction with a lack of a well-developed social pension system. The costs of child-rearing, often hampering parents from saving for retirement should be reduced in order to alleviate old-age poverty, especially in the areas of education and the provision of housing for newly-wed children. Additionally, policymakers need to pay more attention to elderly parents likely to face retirement without sufficient financial preparation due to the transition period: the responsibility for supporting the elderly is shifting from family members (particularly sons) to the elderly themselves and to the state.

REFERENCES

Arnold, F. (1997). Gender preferences for children. *Demographic and Health Surveys Comparative Studies, 23*, 1–56.

Barcellos, S. H., Carvalho, L. S., & Lleras-Muney, A. (2014). Child gender and parental investments in India: are boys and girls treated differently?. *American Economic Journal: Applied Economics*, *6*(1), 157-189.

Becker, G. S. (1974). A theory of social interactions. *Journal of Political Economy*, *82*(6), 1063-1093.

_____ & Tomes, N. (1976). Child endowments and the quantity and quality of children. *Journal of Political Economy*, *84*(4, Part 2), S143-S162.

Bernheim, B. D. (1991). How strong are bequest motives? Evidence based on estimates of the demand for life insurance and annuities. *Journal of Political Economy*, *99*(5), 899-927.

_____ , Shleifer, A., & Summers, L. H. (1985). The strategic bequest motive. *Journal of Political Economy, 93*(6), 1045-1076.

Black, S. E., Devereux, P. J., & Salvanes, K. G. (2005). The more the merrier? The effect of family size and birth order on children's education. *The Quarterly Journal of Economics*, *120*(2), 669-700.

Booth, A. L., & Kee, H. J. (2009). Birth order matters: the effect of family size and birth order on educational attainment. *Journal of Population Economics*, *22*(2), 367-397.

Brown, P. H., Bulte, E., & Zhang, X. (2011). Positional spending and status seeking in rural China. *Journal of Development Economics*, *96*(1), 139-149.

Bu, F. (2014). Sibling configurations, educational aspiration and attainment (No. 2014-11). ISER Working Paper Series.

Chau, T. W., Hongbin, L., Liu, P. W., & Zhang, J. (2007). Testing the collective model of household labor supply: evidence from China. *China Economic Review 18*(4):389- 402.

Chen, Y., Li, H., & Meng, L. (2013). Prenatal sex selection and missing girls in China: Evidence from the diffusion of diagnostic ultrasound. *Journal of Human Resources, 48*(1), 36-70.

Chung, W., & Gupta, M. D. (2007). The decline of son preference in South Korea: The roles of development and public policy. *Population and Development Review*, *33*(4), 757-783.

Coward, R. T., & Dwyer, J. (1990). The association of gender, sibling network composition, and patterns of parent care by adult children. *Research on Aging*, 12, 158-181.

Cox, D. (1987). Motives for private income transfers. *Journal of Political Economy*, *95*(3), 508-546.

Das Gupta, M., Zhenghua, J., Bohua, L., Zhenming, X., Chung, W., & Hwa-Ok, B. (2003). Why is son preference so persistent in East and South Asia? A cross-country study of China, India and the Republic of Korea. *The Journal of Development Studies*, *40*(2), 153-187.

Dwyer, J., & Coward, R. T. (1991). A multivariate com- parison of the involvement of adult sons versus daughters in the care of impaired parents. *Journal of Gerontology: Social Sciences*, 46, S259-269.

Gupta, M. D. (1987). Selective discrimination against female children in rural Punjab, India. *Population and Development Review*, 77-100.

Hauser, R. M., & Sewell, W. H. (1985). Birth order and educational attainment in full sibships. *American Educational Research Journal, 22*(1), 1-23.

Hoddinott, J., & Haddad, L. (1995). Does female income share influence household expenditures? Evidence from Cote D'Ivoire. *Oxford Bulletin of Economics and Statistics, 57*(1), 77–96.

Hotz, V. J., & Pantano, J. (2015). Strategic parenting, birth order, and school performance. *Journal of Population Economics*, *28*(4), 911-936.

Jayachandran, S., & Kuziemko, I. (2011). Why do mothers breastfeed girls less than boys? Evidence and implications for child health in India. *The Quarterly Journal of Economics*, *126*(3), 1485-1538.

Kessler, D. (1991). Birth order, family size, and achievement: Family structure and wage determination. *Journal of Labor Economics*, *9*(4), 413-426.

Kim, H. (2010). Intergenerational transfers and old-age security in Korea. *The Economic Consequences of Demographic Change in East Asia, NBER-EASE Volume 19*: 227-78.

Kim, J. (2005). Sex selection and fertility in a dynamic model of conception and abortion. *Journal of Population Economics*, *18*(1), 41-67.

Kim, S. et al. (2012). The national survey on marriage and fertility dynamics. Ministry of Health and Welfare, KIHASA.

Kim, Y. H., Lee, H. O., Lee, K. H., & Kim, J. H. (1994). The survey of marriage cost and consciousness. *Chung Ang Journal of Human Ecology*, *8*, 183-202.

Lee, C., & Lee, E. (2015). Son Preference, sex-selective abortion, and parental investment in girls in Korea: Evidence from the year of the white horse. *NBER Cohort Studies Meeting.*

Lee, S. H., Mason, A., & Park, D. (2011). Why does population aging matter so much for Asia? Population aging, economic security and economic growth in Asia. *ERIA Discussion Paper Series, 4*, 1-34.

Lee, S. Y. (2011). A study of change in cost of housing at marriage by age group in terms of intergenerational transfers. *Journal of Korean Management Association, 29*(4), 205-16.

Lillard, L. A., & Willis, R. J. (1997). Motives for intergenerational transfers: Evidence from Malaysia. *Demography*, *34*(1), 115-134.

Lin, I. F., Goldman, N., Weinstein, M., Lin, Y. H., Gorrindo, T., & Seeman, T. (2003). Gender differences in adult children's support of their parents in Taiwan. *Journal of Marriage and Family*, *65*(1), 184-200.

Lundborg, P., Nilsson, A., & Rooth, D. O. (2014). Adolescent health and adult labor market outcomes. *Journal of Health Economics*, *37*, 25-40.

Manser, M., & Brown, M. (1980). Marriage and household decision-making: A Bargaining Analysis. *International Economic Review 21*(2):31–44.

McElroy, M. B., & Horney, M. J. (1981). Nash-bargained household decision: Toward a generalization of the theory of demand. *International Economic Review* 22(2):333–49.

OECD. (2017a). Labour force participation rate (indicator). doi: 10.1787/8a801325-en (Accessed on 11 April 2017)

_____. (2017b). Poverty rate (indicator). doi: 10.1787/0fe1315d-en (Accessed on 11 April 2017)

Park, J. (2015). Consumption structure and the burden of education expense in a household with students. *Health and Welfare, Issue&Focus*, 1-8.

Price, J. (2008). Parent-child quality time does birth order matter?. *Journal of Human Resources*, *43*(1), 240-265.

Qian, N. (2008). Missing women and the price of tea in China: The effect of sex-specific earnings on sex imbalance. *The Quarterly Journal of Economics*, *123*(3), 1251-1285.

Raju, K.N.M. & Bhat, T.N. (1995). Sex composition of living children against socio-economic variables while accepting family planning methods. *Demography India 24*:87–99.

Shuey, K., & Hardy, M. A. (2003). Assistance to aging parents and parents-in-law: Does lineage affect family allocation decisions?. *Journal of Marriage and Family*, *65*(2), 418-431.

Stoller, E. P. (1990). Males as helpers: The role of sons, relatives and friends. *The Gerontologist, 30*, 228-235.

Strauss, J., & Thomas, D. (1995). Human resources: Empirical modeling of household and family decisions. *Handbook of Development Economics*, *3*, 1883-2023.

Sun, R. (2002). Old age support in contemporary urban China from both parents' and children's perspectives. *Research on Aging*, *24*(3), 337-359.

Thomas, D. (1990). Intra-household resource allocation: an inferential approach. *Journal of Human Resources, 25*(4):635–64.

Wang, H., Sekine, M., Chen, X., Kanayama, H., Yamagami, T., & Kagamimori, S. (2007). Sib-size, birth order and risk of overweight in junior high school students in Japan: results of the Toyama Birth Cohort Study. *Preventive Medicine*, *44*(1), 45-51.

Wei, S. J., & Zhang, X. (2011). The competitive saving motive: Evidence from rising sex ratios and savings rates in China. *Journal of Political Economy*, *119*(3), 511-564.

Wong, E. S. (2013). Gender preference and transfers from parents to children: an inter-regional comparison. *International Review of Applied Economics*, *27*(1), 61-80.

Xie, Y., & Zhu, H. (2009). Do sons or daughters give more money to parents in urban China?. *Journal of Marriage and Family*, *71*(1), 174-186.

Yang, H. (1996). The distributive norm of monetary support to older parents: A look at a township in China. *Journal of Marriage and the Family*, 404-415.

Zhang, W. (2000). Dynamics of marriage change in Chinese rural society in transition: A study of a northern Chinese village. *Population Studies*, *54*(1), 57-69.

CHAPTER 2

CHILDCARE LEAVE BENEFITS AND FERTILITY: EVIDENCE FROM SOUTH KOREA

2.1 Introduction

A growing number of studies show the effect of work and work environment on childbearing decisions. In developed Western countries, high fertility rates are correlated with a high percentage of women performing paid work and pro-family government policies. Accordingly, work and family reconciliation policies are on the political agenda of an increasing number of countries.

South Korea (henceforth Korea) presents a noteworthy case. Since the 1960s, Korea has experienced a very rapid fertility decline; the total fertility rate (TFR) dropped below the population replacement level in 1983 and hovered around 1.6 in the mid-1980s to the mid-1990s. The TFR reached its lowest point (1.08) in 2005 and has stood at around 1.1 to 1.3 since 2005, which is one of the lowest TFR in the world. The decline in fertility rates combined with rising life expectancy quickened the pace of population aging, which in turn has dramatically increased the dependency ratio of the population aged 65 and over, and decreased the proportion of the working-age population. Such demographic changes have consequently raised concerns for various possible socioeconomic impacts as a result, including a decrease in productive potential, reduction in the tax base, and an increase in social security expenditures to support the outsize retired population.

In response to the precipitous decline in fertility rates, the Korean government initiated a five-year plan called the "First Basic Plan on Low Fertility and Aged Society" in 2006. A second five-year plan with a similar set of policies followed the first plan and concluded in 2015. In total, the government invested about USD 800 billion (USD 200 billion for the first plan and USD 600 billion for the second plan) from 2006 to 2015 to support a wide variety of policies intended to raise the fertility rates including extended maternal and paternal leave, tax benefits and health subsidies for childbirth, and childcare leave. Nevertheless, the TFR remained low and stagnated at around 1.2 in recent years, leading to the conclusion that the 10-year pro-natal plans failed to achieve their goals.

Several studies investigated the effectiveness of these government policies. However, the actual impact has not been documented perhaps due to the empirical challenges of evaluating the effectiveness of government policies on actual fertility. Furthermore, previous studies largely overlooked the fact that these policies target marital fertility despite the fact that most previous literature has been conducted for the TFR, which is calculated using data on unmarried as well as married women so this can be misleading. And only a small portion of previous studies focused on childcare leave benefits, which might have one of the largest impacts on marital fertility. A study that does examine childcare leave benefits is conducted by Yoon and Hong (2014). It examines how beneficiaries utilized the changes implemented by the 2011 childcare leave benefits reform depending on their level of income. Nonetheless, it does not closely investigate the effect of the impact of utilization of the program on fertility, which is the main aim of this study.

Using the recent data sets, this study contributes to the existing literature by focusing on married working women at whom the Korean government has directed specific policy, and by

examining actual fertility behavior rather than fertility intention. In 2011, the government substantially modified the childcare leave benefit scheme with the stated intention of increasing the generosity of financial support during the childcare leave period and promoting an increase in the rate at which women return to work following a childcare leave. The changes included the level of financial support and criteria for eligibility. The monetary increase in monthly childcare benefits provided 40 percent of monthly wages with a minimum of USD 500 and a maximum of USD 1,000 compared to a lump sum payment of USD 500 per month prior to the reform. Eligibility criteria and changes in the amount of benefits affected women differently depending on income level—this identifies the effects of the policy before and after implementation of the reform. Utilizing this framework, this study makes causal inferences between the policy and fertility. This study also uses education level as a proxy for a monthly wage in alternative estimation strategies to determine the labor supply effect of the reform. The results show that the reform in childcare leave benefits had a substantial effect on marital fertility as well as contraceptive use. The magnitude of the effect varied depending on the number of already existing children. The results also find evidence of declining career interruption after the reform.

The following section briefly reviews the previous literature. Section 2.3 describes the reform in childcare leave benefits in more detail. Section 2.4 describes the empirical strategy and the data. Section 2.5 and Section 2.6 present the results. Section 2.7 is the Conclusions.

2.2 Literature Reviews

2.2.1 Theoretical Background

The decision to have a child depends on a utility maximization process with a budget constraint and thus is a function of the cost and benefits of having a child and household income (Becker, 1991; Cigno, 1991). It seems that a pro-natal policy has a positive impact on fertility as an increase in government support for childbearing such as family allowances, tax exemptions, and childcare leave increases demand of a child by lowering the cost of childcare or increasing household income.

However, the theoretical direction of a pro-natal policy is ambiguous due to the quality-quantity trade-off (Becker and Lewis, 1973). Childbearing has different dimensions: quantity and quality. This implies that individuals may choose to focus on the quality of child-raising rather than on the quantity of children by concentrating available financial resources. Hence, a pro-natal policy leading to an increase in income does not necessarily increase fertility. Gauthier (2007) suggests more theoretical evidence of the ambiguity of a pro-natal policy impact on fertility. First, while rational choice theories assume that an individual has perfect information regarding the costs and benefits of having a child, imperfect information may prevail in the real economy (Goldthorpe, 2000). In this case, an individual may underestimate or overestimate the likelihood of a possible change brought about through financial support for childbearing, resulting in inconsistent responses. Also, a childbearing decision may depend on whether or not benefits of policies are sufficient for an individual to have more children (Goldthorpe, 2000). This suggests that there may be a need to meet some threshold requirement for an individual to respond to policy changes. Furthermore, some studies argue that an individual's decision to have children can be affected by other factors such as peers, neighbors, habits, and traditions (Becker, 1996; Becker and Murphy, 2000). Thus, if policies aimed at increasing fertility are linked to

these various factors, predicting the impact of pro-natal policies on fertility becomes more complex.

2.2.2 Empirical Studies

As a large number of empirical studies examine the effect of government policies on fertility, the scope of this study will focus on recent studies which use more convincing econometric methodologies.

Kalwij (2010) uses the 2004 European Social Survey and national social expenditure data to show the impact of family allowances, parental leave benefits, and childcare subsidies on fertility from 1980 to 2003 in 16 Western European countries. The results show that family allowance, maternity leave, and childcare subsidies all have a positive effect on fertility rates. Nevertheless, the impact is variegated as family allowance has a significant effect only when specific independent variables are included, and maternity leave has a significant effect only for the first birth. Unfortunately, the study does not provide the reason for the divergent impact.

A study that encompasses all of Europe and uses the same data is Harknett, Billari, and Medalia (2014), which examines data from 2004 to 2005 and 2008 to 2009 to investigate how various macroeconomic variables at the national level affect birth intentions within the following three years and the actual numbers of children born. Policy variables are divided into four areas: labor market, family type, system, and division of labor within the family. In all, the ratio of family support budget to GDP, duration of paid maternity leave, education and health system satisfaction, unemployment rate, flexible working hours, financial and childcare support among grown-up children, the proportion of multi-family households, and division of labor in the husband-wife family are included. Other variables such as age, gender, the number of children,

the age of children, religion, individual level variables, and other macroeconomic variables are also included as controls. The results show that most of the policy variables have a significant impact on the decision to have a second child while showing no effect on the decision to have a first child. According to the authors, the dependent variable is a mixture of the individual level, household level, and national level potentially linked to other national variables that may pose endogeneity concerns.

Luci-Greulich and Thévenon (2013) examine the effect of government spending, child care services, and paid maternity leave on fertility and tempo-adjusted fertility between 1982 and 2007 in the Organization for Economic Co-operation and Development (OECD) member countries. Other independent variables include the female employment rate, average hours of work for women, unemployment rate, labor market protection indicator, the ratio of single mothers, and first child indicator. An important feature of this study is to control using various methods (two-stage least squares using lag parameters, system GMM, two-way FE model, etc.) to alleviate problems such as reverse causality. The results show that policy has a positive impact on the fertility rate. In particular, financial support and childcare service policies implemented at the time of childbirth appear to be more effective than maternity leave and childbirth support policies.

A study by Lappegård (2010) uses Norwegian population data to determine whether various government fertility policies have influenced the birthrate. Policy variables are the use of paid maternity leave (equivalent to 80 percent of the wage for 54 weeks or 100 percent of the wage for 44 weeks), government support for childcare facilities, and childcare allowance. The data are combined with other data sets on income, education, maternity leave, and childcare facilities. The author uses a hazard model including regional fixed-effects. The results show that

each policy variable had a positive effect on childbirth. In particular, maternity leave had a significant effect on the second childbirth while childcare allowance had a greater effect on the first childbirth. The data have some merit as they are merged from different sources, but there is still a potential endogenous problem in large part due to the reverse causation between maternity leave and decision-making around pregnancy. Duvander, Lappegård, and Andersson (2010) analyze the relationship between maternity leave and additional births by analyzing Swedish and Norwegian data. The results show that in both countries, the use of parental leave is closely related to additional births. In addition, in Norway, the use of long-term parental leave by women with two children appears to have a positive impact on the third childbirth.

Milligan (2005) uses the 1991 and 1996 Canadian population census to analyze the effect of childcare allowance on birth. Independent variables are age, education, marital status, the number of existing children, immigrant status, race, household income, weekly growth rate, weekly immigration rate, and provincial education expenditure. Notably, this study employs the difference-in-differences (DID) model, using different systems in Quebec and other provinces. In Quebec, the amount of the support was raised several times in the 1980s and 1990s, while in other provinces, it was not. The results show that the policy is indeed effective in raising the birthrate. In particular, if the number of existing children is higher than two, the probability of additional birth increases by 25 percent. This study is unique as Quebec's policy has applied the DID technique to solve the problems of endogeneity, but it is still possible that unobserved characteristics of Quebec may have provided factors in increasing the fertility rate. A study by Ang (2015) uses similar data and the DID technique to analyze the effects of maternity leave and childcare allowance on the birthrate and female labor force participation using Canadian population census and Labor Force Survey data. The analysis shows that maternity leave

positively affects childbirth and labor market participation rate of women, but childcare allowances are not significant. This paper also proposes to solve the problems of existing papers, but it is also not free from the limitations present in Milligan (2005).

Brewer, Ratcliffe, and Smith (2012) use data from the Family Resource Survey and the Family Expenditure Survey (1995-2004) to determine the effect of the Working Families' Tax Credit (WFTC) on birth in the U.K. The WFTC is a support system that grants tax benefits according to the number of children in a family. It increased benefits in 1999. The benefits mainly target low-income families. Similar to the Canadian case, the study uses the DID technique to compare birthrates before and after the implementation of the policy. The results of the analysis show that the policy had a positive effect on the birthrates for married women, but not for women without a spouse.

González (2013) uses Spanish national statistics, household expenditure surveys, monthly labor force surveys, etc. to determine the effect of the childbirth subsidy system on the number of monthly pregnancies and monthly abortion rate. The study uses the regression discontinuity design to model policy variables. The analysis shows that the policy had a positive impact on childbirth and it also shows that abortion rates declined. The policy also appears to have reduced labor supply after childbirth, meaning the labor supply and birth subsidy are substitutive. Studies by Azmat and González (2010) also show that Spain's income tax reform increases the fertility rate by about 5 percent and increases the employment rate of women with children under the age of 3 by about 2 percent.

Drago et al. (2011) use data from 2001-2006 Household Income and Labor Dynamics to analyze how the baby bonus affected birth intentions. A child allowance has been paid in

Australian dollars of $3000 per child for children born after July 2004, regardless of income, parents' employment status, or birth order. In July 2006 it was increased to $4,000 and again rose to $5,000 in July 2008. Additionally, from 2009 the high-income bracket was excluded. An IV-Probit and a simultaneous equation model were used, in which the authors specifically focus on the interaction of policy and birth intentions. The results show that the child allowance has a significant effect on birth intention. This paper focuses on the interaction between policy and childbirth. However, as the authors suggest, there may be an indication that individuals may not respond immediately to the incentive for childbirth in time, since individuals may have an intention to have children after they have already met all other desirable conditions such as employment and adequate savings. In particular, when the system was introduced in 2004, a plan for raising subsidies in July 2006 was also announced.

Cygan-Rehm (2016) uses the 2001/2002- 2006/2007 German data to investigate the effects of maternity benefits on additional births using the DID technique. The results show that maternity benefits have a significant impact on the timing of additional births. Bauerschuster, Hener, and Rainer (2013) also analyze the impact of public childcare facility use on the total fertility rate using German regional data for children under the age of three. The results also show positive effects.

Cohen, Dehejia, and Romanov (2013) analyze the impact of the child support subsidies on pregnancy outcomes using panel data from the 1995-1999 State Statistics Service of Israel. The fixed-effects method was used as an analysis model. The child support subsidy was introduced in Israel in 1959 as a government subsidy for children under the age of 18. Prior to 2003, the subsidy price had risen sharply, starting with the third child. However, as a part of fiscal reform, the benefits for the third child born after 2003 was lowered to the same level as all

other children. The increase and decrease in the subsidy for children show a significant effect on birthrates, but the effect was relatively low in the high-income group.

Slonimczyk and Yurko (2014) analyze the effect of a maternity capital program on birthrates using the Russian Longitudinal Monitoring Survey data from 2000 to 2011 and using the DID. The maternity capital system was introduced in January 2007 and was in force until 2016. This system grants the right to receive a certain level of financial support, linked to the annual inflation rate, when a woman has two or more children. The average benefits per household in 2007-2012 is about USD 11,000, and the fund usage conditions at the time the system was introduced allow spending only for the purpose of housing purchases, child education, and parenting after the birth of the third child. The results show that the policy has a significant effect on the second and subsequent births. There was a change in other maternity support schemes (maternity leave, maternity subsidies, etc.) at that time, which raises the issues of the comparison group trends. To address this issue, the authors provide additional analysis using a dynamic stochastic model.

Using DID methodology, Yoon and Hong (2014) examine how the 2011 reform in childcare leave benefits affected lower-wage workers and higher-wage workers differently. It uses the Employment Insurance Data Base which spans 2009-2011. The results show that these policy changes increase the use of childcare leave in the treatment group (the higher-wage workers). However, it does not examine whether the policy changes had any impact on fertility. An increase in the utilization of childcare leave benefits does not necessarily mean more fertility. Another difference in Yoon and Hong (2014) from the current study is that they analyze a relatively short time period. Given that it usually takes time for a new policy to be recognized and take full effect, the question needs to be studied over a longer period of time.

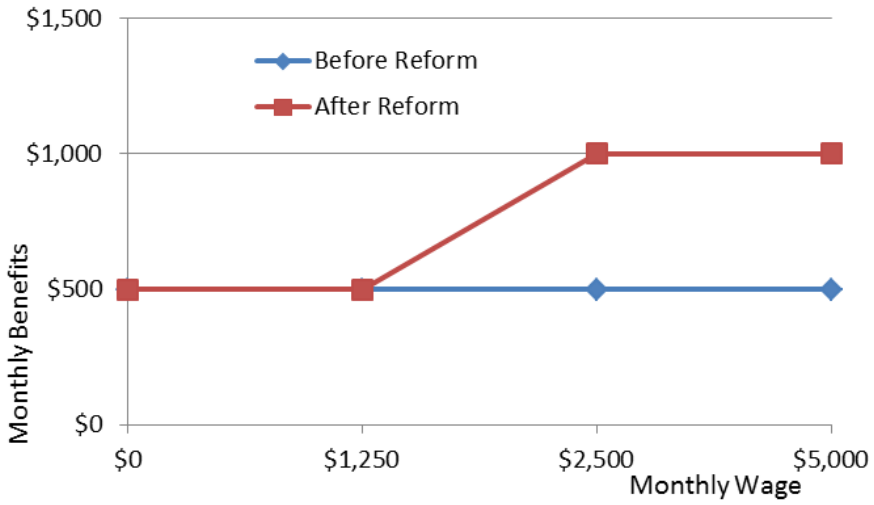
2.3 Reform in Korea's Paid Childcare Leave System

The focus of this study is the 2011 reform in childcare leave benefits in Korea. The government introduced a paid childcare leave scheme in 2001 to provide financial support for employees experiencing a substantial decrease in labor income while on childcare leave. An employee with a child under the age of eight, or in school in second grade or below, is entitled to paid childcare leave. To be eligible, workers must have been employed for more than one year consecutively, up to the day prior to when childcare leave is supposed to begin. Under this system, conditions of household income or children's birth orders are not taken into account. The maximum period of paid childcare leave is one year. Both the father and mother of the child are eligible as long as the periods of the leave do not overlap, but the majority of parents who utilize childcare leave are mothers. The Employment Insurance Fund operated by the government is the source of benefits. The level of childcare leave benefits gradually increased from USD 300[9] per month in 2001-2003 to USD 400 per month in 2004-2006, and to USD 500 per month in 2007-2010.

In 2011, a significant reform aimed at reducing the financial burden of childcare and preventing career interruptions for women following childbirth was introduced. This reform was announced in the "Second Basic Plan on Low Fertility and Aging Society" in November 2010 and went into effect on January 1, 2011. The most substantial change was the level of financial benefits, which changed from a monthly lump sum payment of USD 500 to a payment equivalent to 40 percent of ordinary monthly wages. The minimum monthly payment was set at USD 500 to prevent reduced payments following the reform, and the maximum payment was capped at USD 1,000. Thus, the exact amount depended on monthly wages and duration of the childcare leave. Figure 2.1 shows the relationship between monthly wages and childcare benefits before and after

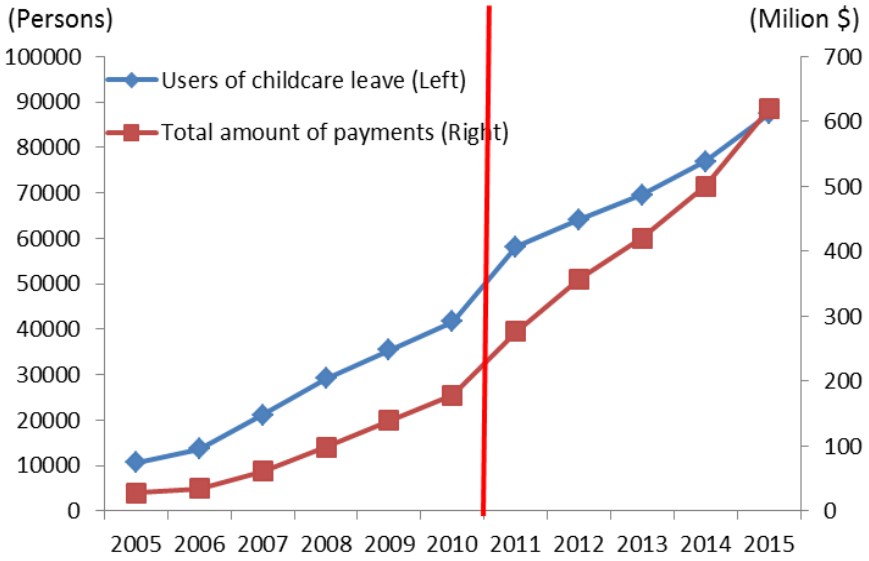
[9] This study assumes the exchange rate between Korean won and U.S. dollar as fixed: 1 dollar = 1,000 won.

Figure 2.1. Monthly Wage and Childcare Leave Benefits before and after the Reform



the 2011 reform. The 2011 reform increased childcare benefits for the relatively higher wage group with a monthly wage of over USD 1,250 while having no effect on the lower wage group with a monthly wage of USD 1,250 or less. The government also introduced an incentive system to encourage women to return to their former workplace after childcare leave as a substantial number (34.2 percent in 2009) of women workers quit or changed jobs following childcare leave. Under this new incentive system, 85 percent of monthly childcare benefits are paid during the leave, and the remaining 15 percent of benefits are paid to those who return to their former workplace and stay for at least six months. However, if 85 percent of monthly benefits fall below USD 500, the program does not apply, thereby avoiding a decrease in payments during the leave. Figure 2.2 presents the number of childcare leave enrollees and the total amount of leave payment from 2005 to 2015. Both have gradually increased over time and showed a fairly rapid increase immediately after the reform was implemented in 2011. The average amount of benefits per enrollee during the whole leave period rose from USD 4,268 in 2010 to USD 7,049 in 2015, and the average duration of childcare leave increased from 8.4 months in 2010 to 10 months in 2015.

Figure 2.2. Users of Childcare Leave and the Total Amount of Leave Payments



Source: the Ministry of Employment and Labor, Republic of Korea (https://www.ei.go.kr).

2.4 Empirical Strategy and Data

2.4.1 Empirical Strategy

To examine the effect of the reform, this study employs the DID approach. I compare the post-reform change in the probability of conception among women in the treatment group to the change in the probability of conception among the women in the control group over the same period. Identification in the DID model relies heavily on the common trends assumption that requires the treatment and control group to follow the same trends in conception before the reform. Thus, I restrict the samples to female wage and salary workers[10].

This study defines the treatment group and control group using two factors. The first factor is the amount of monthly earnings. Only wage and salary workers who earn more than

[10] The data shows that the conception trend for non-working or self-employed women prior to the reform is quite different from that of female wage and salary workers.

USD 1,250 per month are affected by the reform in childcare benefits. In contrast, wage and salary workers who earn USD 1,250 or less per month are not affected by the reform; thus, they are the control group. The second factor is the employment status of the wage and salary workers. The Korean government labor statistics categorize wage and salary workers into two groups: regular and non-regular workers. Regular workers are defined as employees who have unlimited or more than one- or more-year employment contract and have received benefits such as a bonus, retirement benefits, etc. Wage and salary workers who are not regular workers are categorized as non-regular workers, which include temporary and daily workers. Both regular and non-regular workers are officially entitled to paid childcare leave. In reality, however, very few non-regular workers use childcare leave. This is for several reasons: first, paid childcare leave eligibility requires an employee to have worked consecutively for a period exceeding one year, but most non-regular workers do not meet this requirement. Second, non-regular workers tend not to subscribe to Employment Insurance[11], which is required for eligibility. Third, non-regular workers are often concerned about a potential job loss if they were to take childcare leave, although it is illegal for employers to fire workers for taking childcare leave. Park (2016) reports that only 1.9 percent of non-regular workers used childcare leave in 2011-2015 compared to 46.9 percent of regular workers.

Based on these two factors, the treatment group in this study includes regular workers who earn more than USD 1,250 per month, and the control group consists of regular workers who earn less than USD 1,250 per month or non-regular workers earning any amount of monthly wage.

[11] According to the Korean Employment Insurance Act, all workplaces employing one worker or more are subject to the Employment Insurance System. However, a substantial portion of non-workers do not subscribe to it.

2.4.2 Data

I use the 2006, 2009, 2012, and 2015 National Fertility and Family Health Survey as data sets. This is a national cross-sectional survey conducted triennially by the Ministry of Health and Welfare and the Korea Institute for Health and Social Affairs. The survey interviews married women[12] aged 19-49 from approximately 6,000-10,000 households. I exclude separated or divorced women because the questions on conception, birth, and contraception were not posed to such women at the time of the survey. The sample size of each survey varies depending on the year; thus weights are applied. The survey contains information on pregnancies, births, use of contraception, health status, employment, and other household attributes. I restrict the samples to female wage and salary workers aged 19-49, and the total number of collected sample is 11,416. The 2006 and 2009 surveys represent the "before" periods while the 2012 and 2015 surveys stand for the "after" period in the DID approach.

Despite its representativeness and comprehensiveness, the data do have some limitations. The data contains little retrospective information on wages, though fertility history is reported extensively. Thus, there is a chronological gap in attempting to match women's fertility information and wages. For instance, as shown in Table 2.1, the 2009 survey was conducted in June 2009 and contains information on average wages during the three months prior to the as conceptions and births from January 2007 to June 2009. The other surveys have a similar survey: from April 2009 to June 2009. However, the survey asks about fertility information such chronological gap as well. Given the causal inference of this study—that the childbearing decisions of women are affected by the level of monthly wages they earn—a large gap in time

[12] Childbirth by unmarried women is fairly exceptional in Korea.

Table 2.1. Time of Each Survey

	Date surveyed	Fertility history (Conceptions, Births)	Wage (Avg. 3 months prior to the survey)
Survey 2006	Jun.2006	Lifetime	Apr.-Jun.2006
Survey 2009	Jun.2009	Jan.2007-Jun.2009	Apr.-Jun.2009
Survey 2012	Apr.2012	Jan.2010-Apr.2012	Feb.-Apr.2012
Survey 2015	Aug.2015	Lifetime	Jun.-Aug.2015

Source: the National Fertility and Family Health Survey.

between these two variables may affect the results. Therefore, in order to narrow this gap as much as possible, this study uses "conception[13]" instead of "birth" as a dependent variable and restricts the period of analysis to 12 months: one calendar year before the date surveyed (see Table 2.2). Despite this, a maximum possible 16-month gap can still exist between conception and wages information. Therefore, the study assumes that wages do not change during for the period studied.

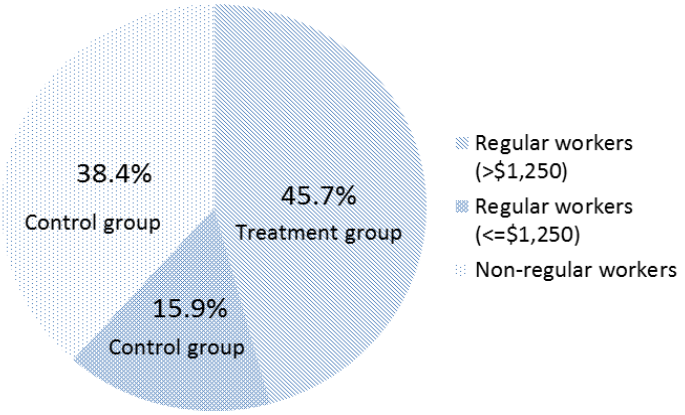
Table 2.2. Time Period of Analysis

	Conceptions	Wage
Survey 2006	2005	Apr.-Jun.2006
Survey 2009	2008	Apr.-Jun.2009
Survey 2012	2011	Feb.-Apr.2012
Survey 2015	2014	Jun.-Aug.2015

[13] By employing conception rather than birth as a dependent variable, the gap between the time of fertility decision and wages is reduced by around 40 weeks.

Figure 2.3 illustrates the work status categorization of women in the observations where 45.7 percent of female wage and salary workers are regular workers who earn a wage of more than USD 1,250 per month, and 15.9 percent of female wage and salary workers are regular workers who earn a wage of USD 1,250 or less. The portion of non-regular workers is 38.4 percent. Consequently, 54.3 percent of the samples belong to the control group, and the share of the treatment group in the samples is 45.7 percent.

Figure 2.3. Work Status Categorization in the Samples



Note: Calculated by the authors using the 2006, 2009, 2012, and 2015 National Fertility and Family Health Survey.

Table 2.3 shows the means and standard deviations for the dependent variable and some key control variables separated by the control and treatment group before and after the reform. As expected, the level of education, wages, and household income of the treatment group are higher than those of the control group. Whereas the probability of conception for the control group declined from 3.2 percent in the pre-reform period to 2.1 percent in the post-reform period, that of the treatment group increased from 8.1 percent to 9.2 percent. It seems that there is a somewhat significant impact on conception in the treatment group, relative to the control group.

Table 2.3. Descriptive Statistics (Wage and Salary Workers Aged 19-49)

Variable	Control group		Treatment group	
	2005 & 2008 (Before)	2011 & 2014 (After)	2005 & 2008 (Before)	2011 & 2014 (After)
Conception (%)	3.2	2.1	8.1	9.2
Age	39.5 (6.3)	40.8 (5.8)	36.6 (6.4)	39.1 (6.2)
Age (if they conceive)	31.7 (4.9)	33.4 (5.2)	30.9 (3.8)	32.8 (3.7)
Number of children	1.8 (0.8)	1.8 (0.8)	1.4 (0.9)	1.5 (0.9)
Number of children (if conceive)	0.9 (0.9)	0.9 (0.8)	0.5 (0.6)	0.8 (1.0)
Education (College or above =1)	0.2 (0.4)	0.4 (0.5)	0.7 (0.5)	0.7 (0.5)
Monthly wages (US$)	966 (514)	1,150 (594)	2,333 (1,060)	2,445 (1,171)
Household incomes (US$)	3,228 (1,407)	4,427 (1,926)	5,203 (2,269)	6,123 (2,972)
Observations	2,912	3,265	1,419	3,824

Notes: Calculated by the authors using the National Fertility and Family Health Survey. Displayed are the means or percent for each variable, with the standard deviation in parentheses. The control group includes employees who are non-regular workers with monthly wages of $1,250 or less, or non-regular workers, and the treatment group includes employees who are regular workers with monthly wages of more than $1,250.

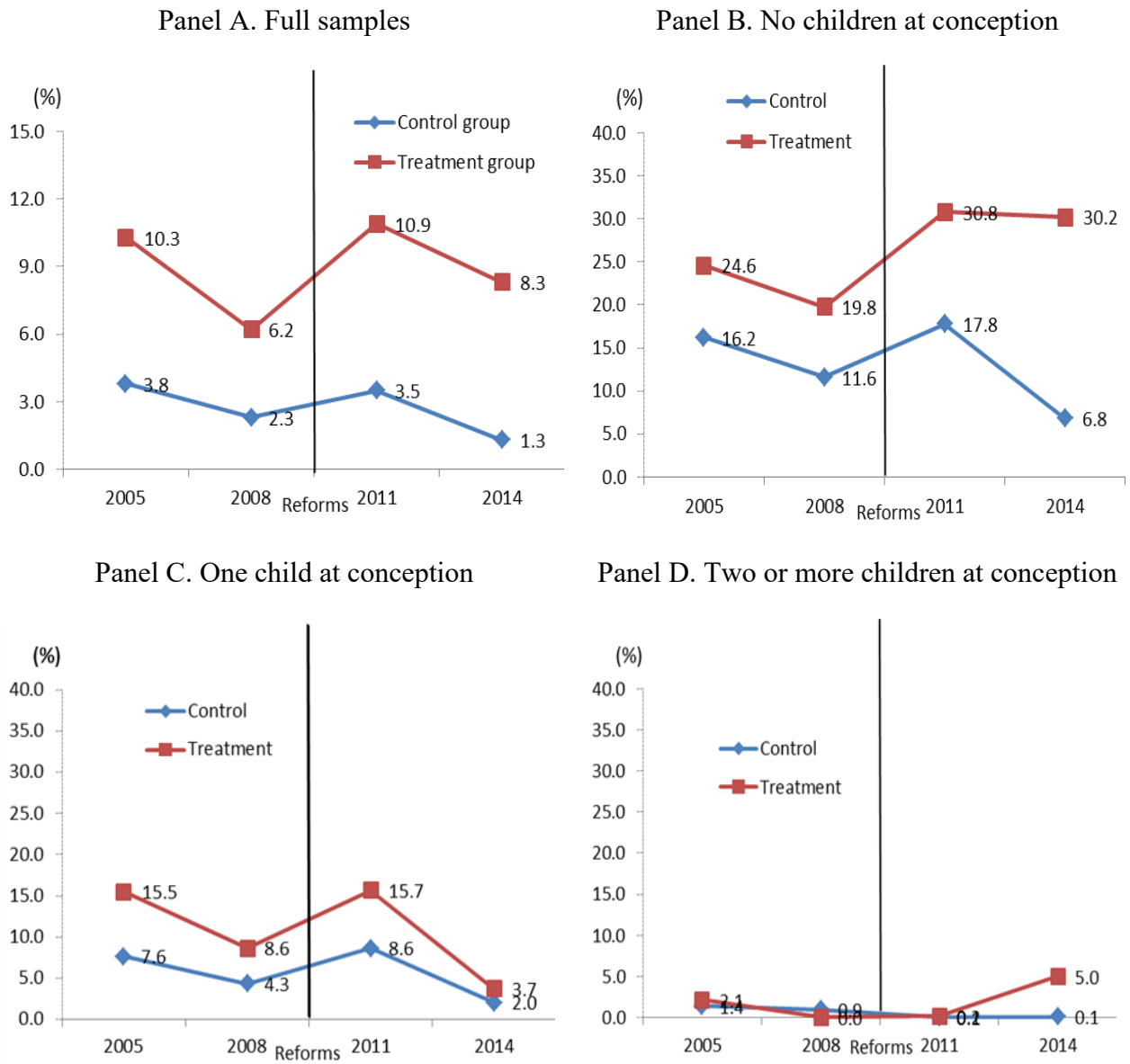
2.5 Results

2.5.1 The Impact on Conception

Descriptive Analysis

If we expect economic incentives to matter in stimulating fertility, then an increase in the probability of conception in the treatment group should be observed after the reform. Figure 2.4

Figure 2.4. Probability of Conception in Women Aged 19-49 (Wage and Salary Workers)



Note: Calculated by the authors using the 2006, 2009, 2012, and 2015 National Fertility and Family Health Survey.

displays the probability trend of conception in both the control and treatment groups, dividing the sampled women by the number of children they've had. The conception trends in the control and treatment group are relatively similar before the policy changes, in all cases. After the policy changes, the probability of conception in the treatment group seems to increase more than in the

control group in full samples. The impacts of the policy are clear in cases where a woman has no children or two or more children in 2014.

However, this descriptive analysis does not always provide accurate results since it does not control for other factors which are likely to affect fertility decisions. Thus, I capture the policy impact more precisely by using a multivariate DID regression in the following subsection.

Regression Analysis

To estimate the impact of the reform, this study uses the following equation:

$$Y_i = \alpha_0 + \alpha_1 After_i + \alpha_2 Treatment_i + \alpha_3 (After_i \times Treatment_i) + \beta X_i + \varepsilon_i , \quad (2.1)$$

The outcome of interest here is the binary variable (Y_i), which is equal to one if the woman conceived in the previous calendar year, and equal to zero otherwise. The basic DID specification includes a binary variable $After_i$ which is equal to one in the post-reform period and equal to zero in the pre-reform period. Similarly, the binary variable $Treatment_i$ is equal to one if the woman belongs to the treatment group and equal to zero otherwise. An interaction term $After_i \times Treatment_i$ captures the difference in the change in the probability of conception after the reform for the treatment group compared to the control group. Thus, the coefficient α_3 represents the effect of the reform. X_i is a vector of individual characteristics, which are assumed to be related to the conception decision. X_i includes age, age squared, the number of already existing children at conception, education, a place of residence, employment status, husband's work status, logged labor income, and logged household income. Equation (2.1) is estimated by the linear probability model.

Table 2.4. Regression Results: Conception

	(1)
After × Treatment	0.037***
	(0.012)
After	-0.006
	(0.005)
Treatment	-0.008
	(0.011)
Age	-0.007
	(0.007)
Age^2	0.00002
	(0.0008)
Number of existing children[a]	
One child	-0.115***
	(0.018)
Two or more children	-0.144***
	(0.016)
Education (College or above =1)	0.021***
	(0.005)
Other characteristics[b]	Yes
Observations	11,416
Adj. R-squared	0.119

Notes: Robust standard errors in parentheses. *, **, and *** indicate statistical significance at the 10, 5, and 1 percent level, respectively.
[a] Reference: No children.
[b] Dummies for employment status, region, and husband's work status, monthly wage (logged) and household income (logged).

Regression results, reported in Table 2.4, show a statistically significant increase in the conception for the treatment group after the reform compared to the control group. The coefficient is 3.7 percent which implies that the probability of conception increased by 45.6 percent[14] in the treatment group as a result of the reform. On the other hand, a large number of studies find that policy impacts on fertility vary by birth order. For example, in one finding,

[14] In the raw data, the probability of conception in the treatment group before the reform was 8.1 percent.

financial incentives have a greater effect on first and third births (Brewer et al., 2012; Laroque and Salanie, 2008; Berrington, 2004). The authors argue that these results reflect strong underlying preferences for having two children. Thus, the decision to have a second child is less likely to be responsive to financial incentives than the decision to have the first child or third or higher-order child. Accordingly, I run the regressions by the number of already existing children in the family. The estimation results in this study show that, in response to the reform, the probability of conception for women with no children or more than two children rises significantly: by 10.1 percentage points and 3.8 percentage points, respectively (see Table 2.5). Given that the probabilities of conception for the treatment group before the reform are 22.2

Table 2. 5. Regression Results by the Number of Existing Children: Conception

	(1) No children	(2) One child	(3) Two or more children
After × Treatment	0.101**	-0.008	0.038***
	(0.050)	(0.035)	(0.007)
After	-0.007	-0.013	-0.006**
	(0.037)	(0.021)	(0.003)
Treatment	0.011	0.013	-0.025***
	(0.045)	(0.029)	(0.006)
Age	0.039**	0.019	-0.036***
	(0.018)	(0.016)	(0.007)
Age^2	-0.0007***	-0.0003	0.0004***
	(0.0002)	(0.0002)	(0.0009)
Education (College or above =1)	0.050*	0.033**	0.015***
	(0.028)	(0.013)	(0.003)
Other characteristics[a]	Yes	Yes	Yes
Observations	1,417	2,202	7,797
Adj. R-squared	0.071	0.048	0.056

Notes: Robust standard errors in parentheses. *, **, and *** indicate statistical significance at the 10, 5, and 1 percent level, respectively.

[a] Dummies for employment status, region, the number of existing children(only in (3)), and husband's work status, monthly wage (logged) and household income (logged).

percent for women with no children and 1.1 percent for women with more than two children, these results seem to be sizable.

Table 2.6 shows the estimated effects when the interaction terms for the treatment group with each year's dummy are included. Column (1) of Table 2.6 shows that there are positive effects on conception for the treatment group after the reform compared to 2008. The most statistically significant effect (with a *p*-value of 0.000) is in the year 2014: a 4.7 percentage point increase in the probability of conception. The impact in the year 2011 is a 4.0 percentage point increase with a 10 percent significance level. By contrast, there is no significant effect in the pre-reform period (the year 2005), and the magnitude of its coefficient is smallest. I also separately run the regressions by the number of existing children. The results find that there is a significant positive effect in the year 2014 in cases where there were no children in the family already: a 12.6 percentage point increase. There are also positive effects in both the year 2011 and the year

Table 2.6. Heterogeneous Effects over Time: Conception

	(1) All	(2) No children	(3) One child	(4) Two or more children
Treatment × Year 2005[a]	0.017 (0.016)	-0.001 (0.068)	0.025 (0.043)	-0.008 (0.009)
Treatment × Year 2011[a]	0.040* (0.022)	0.062 (0.079)	0.032 (0.072)	0.018*** (0.006)
Treatment × Year 2014[a]	0.047*** (0.012)	0.126** (0.063)	-0.022 (0.031)	0.053*** (0.007)
Other characteristics[b]	Yes	Yes	Yes	Yes
Observations	11,416	1,417	2,202	7,797
Adj. R-squared	0.120	0.072	0.068	0.058

Notes: Robust standard errors in parentheses. *, **, and *** indicate statistical significance at the 10, 5, and 1 percent level, respectively.
[a] Reference: Treatment × Year 2008.
[b] Dummies for treatment, year, employment status, region, the number of existing children(in (1), (3)), and husband's work status, monthly wage (logged) and household income (logged).

2014 in families with two or more children: a 1.8 percentage point increase and a 5.3 percentage point increase, respectively.

2.5.2 The Impact on Contraception

Levin (2002) argues that contraceptive use is one stage in the "fertility decision tree", which includes sexual activity, contraception, pregnancy, abortion and birth, and consistent results in different stages augment the reliability of evaluation studies. This study employs the "use of contraception" as an alternative dependent variable. The value of this variable is equal to one if a woman reports contraception use at the time of the interview[15] or equal to zero otherwise. I estimate a linear probability model using the same DID regression model as the one in the previous subsection.

Column (1) of Table 2.7 shows that there was a 3.7 percentage point decrease in contraceptive use by the treatment group after the reform, compared to the control group. The negative sign of the coefficient might suggest an increase in the intention to have a child. This result is statistically significant at the 1 percent level. The coefficient of -3.7 percentage points implies that the use of contraception decreased by 4.5 percent[16] in the treatment group due to the reform. Column (2) of Table 2.7 shows the policy effects from the DID estimation where the interaction terms for the treatment group with each year's dummy are included. The negative effect (-3.4 percentage points) in 2015 is statistically significant at the 10 percent level compared to 2009, while the effect in 2012 is also negative, but not statistically significant (with a *p*-value of 0.185). The effect in 2006 is not significant, and the magnitude of the coefficient is closer to

[15] Unlike conception, contraception data are from 2006, 2009, 2012, and 2015 since the surveys ask whether or not the women use contraception as of the date of the interview.

[16] The probability of using contraception in the treatment group before the reform was 85.3 percent.

zero. These regression results are consistent with the results of the previous regression model, which uses "conception" as the dependent variable.

Table 2.7. Regression Results: Use of Contraception

	(1)	(2)
Treatment × After	-0.037***	
	(0.014)	
Treatment × Year 2006[a]		0.003
		(0.021)
Treatment × Year 2012[a]		-0.028
		(0.021)
Treatment × Year 2015[a]		-0.034*
		(0.018)
Age	0.007	0.006
	(0.008)	(0.008)
Age2	-0.00006	-0.00005
	(0.00009)	(0.00009)
Number of existing children[b]		
One child	0.320***	0.321***
	(0.022)	(0.022)
Two or more children	0.483***	0.483***
	(0.021)	(0.021)
Education (College or above =1)	-0.010	-0.009
	(0.007)	(0.007)
Other characteristics[c]	Yes	Yes
Observations	10,627	10,627
Adj. R-squared	0.216	0.217

Notes: Robust standard errors in parentheses. *, **, and *** indicate statistical significance at the 10, 5, and 1 percent level, respectively.
[a] Reference: Treatment × Year 2009.
[b] Reference: No children.
[c] Dummies for treatment, after(in (1)), year(in (2)), employment status, region, and husband's work status, monthly wage (logged) and household income (logged).

2.6 Further Analysis: Considering the Impact on Labor Supply

There is often a strong link between fertility policies and female labor force participation (Gauthier, 2007). Moreover, the 2011 reform in Korean childcare leave benefits aims at not only increasing financial support for families with children but also lowering career interruptions for women after having given birth. If these intended effects are substantial in the treatment group post-reform, it may be causing a sizable policy effect, captured in the previous analysis (an increase in conception by 45.6 percent). In other words, the estimated policy effects of in DID approach may be biased upward if the probability of quitting work after childbirth shrinks more in the treatment group than the control group post-reform. It may stem from selection bias in that women who quit their jobs after childbirth are excluded from the samples because they are not classified as workers in the data sets.

In order to estimate the policy effect appropriately, therefore, it is essential to examine how the reform affects women's career interruptions comparing the control and treatment group. The National Fertility and Family Health Survey data contain information on the work status of women before and after childbirth. It does not include any retrospective wage information on past jobs, however. As a result, it is impossible to sort the women who left their jobs who were regular workers before childbirth into the control and treatment group by the level of monthly wages. Instead, I use education[17] as a proxy for monthly wages to classify regular workers for the control or treatment group. The treatment group includes regular workers whose education level is equal to college or higher (high education), while the control group includes regular workers whose level of education is below college (low education) and non-regular workers of

[17] Brewer et al. (2012) argue that education is a good proxy for income to define treatment and control group because education is not affected by pro-natal policies in the short term at least.

any education level. The potential weakness of using education as a proxy for monthly wages is that it may be less strongly associated with the impact of the reform.[18] This may be a limitation of our study. Table 2.8 shows how closely education is correlated to monthly wages in the data sets, summarizing the mean and median wage of regular workers by their education level. As expected, the mean and median wage of regular workers with high education is around 50-60 percent higher than that of regular workers with low education. This suggests that education level is quite valid as a proxy for monthly wages.

Figure 2.5 illustrates the percentage of women who quit their jobs after childbirth among all workers and pregnant workers, respectively. This figure confirms the considerable drop in job discontinuity in the treatment group and a slight increase in the control group after the reform. For example, the ratio of women who quit work after childbirth, to pregnant women in total, decreased from around 26 percent pre-reform to around 8 percent post-reform in the treatment group, while it increased from around 31 percent to around 40 percent in the control group. This implies that estimations of the policy impact on conception in the previous section can be biased upward. In order to correct the potential bias of the previous results, I estimate the equation (2.1), including women who left the workforce, by using education level as a proxy for a monthly wage.

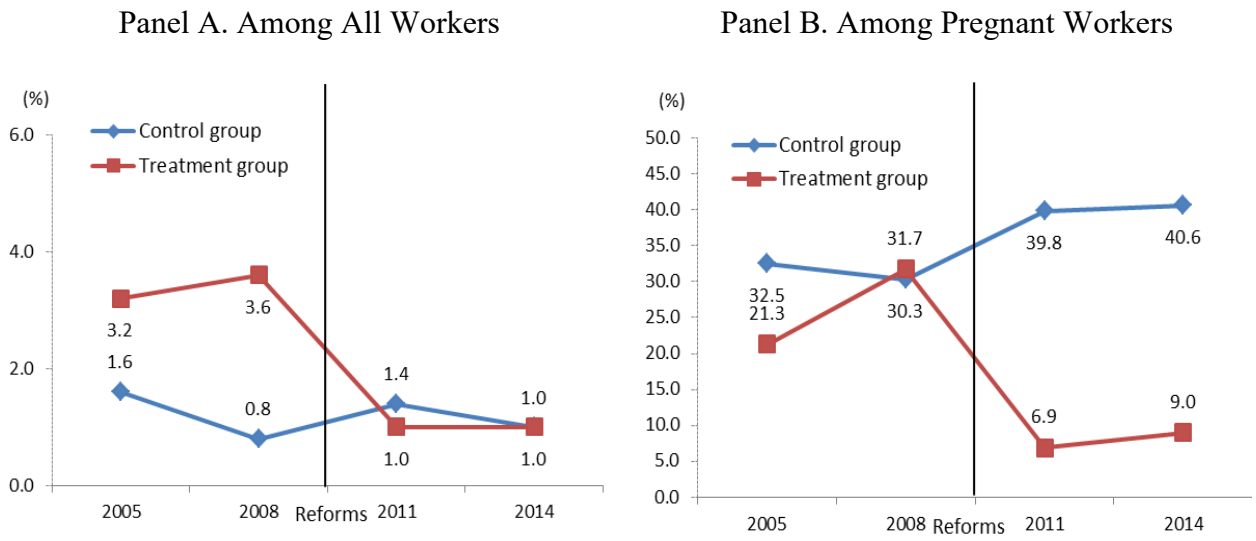
Table 2.8. Monthly Wages of Regular Workers by Education

	Proportion	Mean Wage	S.D.	Median Wage
Regular workers with low education	38.4%	$1,500	$770	$1,350
Regular workers with high education	61.6%	$2,410	$1,250	$2,000

Notes: Calculated by the authors using the 2006, 2009, 2012, and 2015 National Fertility and Family Health Survey.

[18] There are some women with high (low) education whose monthly wage is below (above) USD 1,250.

Figure 2.5. The Percentage of Women Who Quit Their Jobs after Childbirth



Note: Calculated by the authors using the 2006, 2009, 2012, and 2015 National Fertility and Family Health Survey.

Table 2.9 shows the main regression results from the DID approach where the control and treatment group are defined by employment status and education level. The results show a 3.0 percent point increase in conception among all samples, although the significance of this result is somewhat less than the result in the previous section. An increase of 3.0 percent points means that the probability of conception increased by 22.9 percent in the treatment group as a result of the reform. The magnitude of the policy effect is reduced from 45.6 percent to 22.9 percent after including job discontinuities in the estimation.

When I run regression separately by the number of existing children, the policy effect on women who have no children substantially decreases, from 10.1 percentage points in section 2.5 to 3.6 percentage points in Column (1) of Table 2.10, and becomes not statistically significant. This results from the fact that around 80 percent of job discontinuities occur with the first birth in the sample; the potential upward bias in Section 2.5 is indeed substantial in cases of women with

no children at the time of reported conception. However, the positive policy effect of the reform (a 3.0 percentage point increase) in cases of families with two or more children is still statistically significant at the 1 percent level (see Column (3) of Table 2.10). In order to examine the heterogeneous policy effects over time, I include interaction terms for the treatment group with each year's dummy in the estimation model.

Table 2.9. Regression Results: Including Women Who Left the Workforce after Childbirth (Dependent Variable: Conception)

	(1)
After × Treatment	0.030**
	(0.014)
After	-0.001
	(0.006)
Treatment	0.020*
	(0.011)
Age	-0.013*
	(0.007)
Age^2	0.00009
	(0.0008)
Number of existing children[a]	
One child	-0.168***
	(0.019)
Two or more children	-0.197***
	(0.017)
Other characteristics[b]	Yes
Observations	11,588
Adj. R-squared	0.163

Notes: Robust standard errors in parentheses. *, **, and *** indicate statistical significance at the 10, 5, and 1 percent level, respectively.
[a] Reference: No children.
[b] Dummies for employment status, region, and husband's work status, monthly wage (logged) and household income (logged).

Table 2.10. Regression Results by the Number of Existing Children: Including Women Who Left the Workforce after Childbirth (Dependent Variable: Conception)

	(1) No Children	(2) One Child	(3) Two or more children
After × Treatment	0.036	0.010	0.030***
	(0.056)	(0.037)	(0.009)
Individual's characteristics[a]	Yes	Yes	Yes
Observations	1,556	2,222	7,810
Adj. R-squared	0.056	0.054	0.058

Notes: Robust standard errors in parentheses. *, **, and *** indicate statistical significance at the 10, 5, and 1 percent level, respectively.
[a] Dummies for after, treatment, employment status, region, number of existing children(in (3)), and husband's work status, monthly wage (logged) and household income (logged).

Table 2.11 shows that there are positive effects on conception in the treatment group post-reform (4.8 percentage points for the year 2011; 2.7 percentage points for the year 2014): they are statistically significant at the 10 percent level. And while there is a positive differential in the pre-reform period (the year 2005), the magnitude of its coefficient is quite smaller compared to other years, and not statistically significant.

Table 2.11. Heterogeneous Effects over Time: Including Women Who Left the Workforce after Childbirth (Dependent Variable: Conception)

	(1)
Treatment × Year 2005[a]	0.010
	(0.019)
Treatment × Year 2011[a]	0.048*
	(0.027)
Treatment × Year 2014[a]	0.027*
	(0.015)
Individual's characteristics[b]	Yes
Observations	11,588
Adj. R-squared	0.230

Notes: Robust standard errors in parentheses. *, **, and *** indicate statistical significance at the 10, 5, and 1 percent level, respectively.
[a] Reference: Treatment × Year 2008.
[b] Dummies for treatment, year, employment status, region, the number of existing children, and husband's work status, monthly wage (logged) and household income (logged).

I also estimate the effect of the reform on the use of contraception using education level as a proxy for a monthly wage. The results are reported in Table 2.12. Contraceptive use by the treatment group decreased by 4.2 percentage points[19] after the reform compared to the control group. When interaction terms for the treatment group with a dummy for each year are included, there are negative differentials for the treatment group post-reform (2012 and 2015) though it is statistically significant only in the year 2012. By contrast, the policy effect in the pre-reform period (2006) is positive, but not statistically significant. These results support the notion that the 2011 reform led to a decrease in contraception use in the high education group compared to the low education group.

Table 2.12. Regression Results: Using Education as a Proxy for Wage (Dependent Variable: Use of Contraception)

	(1)	(2)
Treatment × After	-0.042***	
	(0.015)	
Treatment × Year 2006[a]		0.015
		(0.023)
Treatment × Year 2012[a]		-0.050**
		(0.023)
Treatment × Year 2015[a]		-0.023
		(0.019)
Individual's characteristics[b]		Yes
Observations	10,794	10,794
Adj. R-squared	0.218	0.218

Notes: Robust standard errors in parentheses. *, **, and *** indicate statistical significance at the 10, 5, and 1 percent level, respectively.
[a] Reference: Treatment × Year 2009

[19] The probability of using contraception in the treatment group before the reform was 82.7 percent.

2.7 Conclusions

The 2011 reform in Korean childcare leave policy that enhanced childcare leave benefits for relatively high-income earners provides a good case study for investigating the effect of financial incentives on the decision to have children. By examining the response to government policy changes, this study contributes to the existing literature on fertility policy evaluation. The results find that the 2011 reform had positive impacts on rates of conception for regular workers with relatively high wages (treatment group) when compared to rates of conception for regular workers with lower wages or non-regular workers (control group). The impacts were more substantial in second or higher-order fertility cases. The reform had a consistently negative effect on the use of contraception by the treatment group. The results also find evidence of declining career interruption for the treatment group post-reform compared to the control group. These effects seem a direct result of another stated purpose of the reform: lowering the career interruption of women after giving birth.

Despite the contribution of this study to existing literature on fertility policy evaluation, there may be some limitations. First, DID methodology cannot precisely disentangle individual policy effects. In Korea, during the period under evaluation, changes were made to other policies related to stimulating fertility, including financial assistance to couples with children and enhancement of public childcare services. Therefore, the results of this study may be affected partially by other policy changes. However, given the fact that the paid childcare leave system is a policy solely geared toward encouraging fertility, which is connected only to work status, I argue that effects observed are mainly due to the childcare leave benefits reform. Second, other types of labor supply effects from the reform need to be studied further, if data are available. For

example, the reform might cause women who got are pregnant to enter the labor market or to attempt to earn more in order to receive higher childcare benefits when taking leave.

REFERENCES

Ang, X. L. (2015). The effects of cash transfer fertility incentives and parental leave benefits on fertility and labor supply: Evidence from two natural experiments. *Journal of Family and Economic Issues*, *36*(2), 263-288.

Azmat, G., & González, L. (2010). Targeting fertility and female participation through the income tax. *Labour Economics*, *17*(3), 487-502.

Bauernschuster, S., Hener, T., & Rainer, H. (2013). Does the expansion of public child care increase birth rates? Evidence from a low-fertility country. *Unpublished Manuscript.*

Becker, G. S. (1991). A Treatise on the Family, enl. ed. *Cambridge, Mass: Harvard*.

_____. (1996). *Accounting for tastes*. Harvard University Press.

_____., & Lewis, H. G. (1973). On the Interaction between the Quantity and Quality of Children. *Journal of Political Economy*, *81*(2, Part 2), S279-S288.

_____., & Murphy, K. M. (2000). *Social economics: Market behavior in a social environment*. Harvard University Press.

Berrington, A. (2004). Perpetual postponers? Women's, men's and couple's fertility intentions and subsequent fertility behaviour. *Population Trends*, 117, 9-19.

Brewer, M., Ratcliffe, A., & Smith, S. (2012). Does welfare reform affect fertility? Evidence from the UK. *Journal of Population Economics*, *25*(1), 245-266.

Cigno, A. (1991). Economics of the family. Oxford, England: Clarendon Press.

Cohen, A., Dehejia, R., & Romanov, D. (2013). Financial incentives and fertility. *Review of Economics and Statistics*, *95*(1), 1-20.

Cygan-Rehm, K. (2016). Parental leave benefit and differential fertility responses: Evidence from a German reform. *Journal of Population Economics*, *29*(1), 73-103.

Drago, R., Sawyer, K., Shreffler, K. M., Warren, D., & Wooden, M. (2011). Did Australia's baby bonus increase fertility intentions and births?. *Population Research and Policy Review*, *30*(3), 381-397.

Duvander, A. Z., Lappegård, T., & Andersson, G. (2010). Family policy and fertility: Fathers' and mothers' use of parental leave and continued childbearing in Norway and Sweden. *Journal of European Social Policy*, *20*(1), 45-57.

Gauthier, A. H. (2007). The impact of family policies on fertility in industrialized countries: a review of the literature. *Population Research and Policy Review, 26*(3), 323-346.

Goldthorpe, J. H. (2000). *On sociology: Numbers, narratives, and the integration of research and theory*. Oxford University Press on Demand.

González, L. (2013). The effect of a universal child benefit on conceptions, abortions, and early maternal labor supply. *American Economic Journal: Economic Policy*, *5*(3), 160-188.

Harknett, K., Billari, F. C., & Medalia, C. (2014). Do family support environments influence fertility? Evidence from 20 European countries. *European Journal of Population*, *30*(1), 1-33.

Kalwij, A. (2010). The impact of family policy expenditure on fertility in Western Europe. *Demography*, *47*(2), 503-519.

Lappegård, T. (2010). Family policies and fertility in Norway. *European Journal of Population/Revue européenne de Démographie*, *26*(1), 99-116.

Laroque, G., & Salanie, B. (2008). Does fertility respond to financial incentives?. *CESifo working paper* 2339.

Levine, P. B. (2002). The impact of social policy and economic activity throughout the fertility decision tree (No. w9021). *National Bureau of Economic Research.*

Luci-Greulich, A., & Thévenon, O. (2013). The impact of family policies on fertility trends in developed countries. *European Journal of Population/Revue européenne de Démographie*, *29*(4), 387-416.

Milligan, K. (2005). Subsidizing the stork: New evidence on tax incentives and fertility. *Review of Economics and Statistics*, *87*(3), 539-555.

Park, J. (2016). Work-Family balance and in working women and its policy implications. *Health and Welfare Forum*, 2016.6, 18-36.

Slonimczyk, F., & Yurko, A. (2014). Assessing the impact of the maternity capital policy in Russia. *Labour Economics*, *30*, 265-281.

Yoon, J. Y. & Hong, M. (2014). Effects of the Paid Maternity Leave Policy on Female Employment. *Quarterly Journal of Labor Policy*, *14*(4), 31-57.

CHAPTER 3

HEALTH SHOCKS AND HOUSEHOLD LABOR SUPPLY: THE CASE OF SOUTH KOREA

3.1 Introduction

Health problems may result in substantial loss of household income due to involuntary departure from the labor force, a decrease in hours worked, as well as direct medical expenditures. In response to health problems, spouses may also change the amount of their labor supply. The magnitude and direction of spouses' responses depend mainly on how great the loss of income is, how much spouses can offset lost household earnings, or how much health problems impinge on the activities of daily living and the subsequent need for care giving for affected spouses.

This study examines the effect of health shocks on household labor supply using the Korean Longitudinal Survey of Aging (KLoSA) which interviews middle-to-old age people. Studying the linkage between health shocks and labor supply of household members is important in part because of its strong policy implications. The evidence gathered may shed light on a spouse's choices corresponding to an unexpected health problem: to increase labor supply or to provide care giving for an ailing partner at home. Also, the results regarding household wealth as a measure of income after health problems may be of particular interest to policymakers. A significant portion of the population in aging societies reaches the age where health has a great impact on labor supply. Therefore, an understanding of the linkage between health and

household labor supply in an aging society is essential in the context of associated old-age poverty and the design of the social security system.

Despite its academic importance and policy implications, there are a limited number of studies which investigate this relationship. The theories suggest that negative health shocks can increase spousal labor supply (Ashenfelter, 1980; Heckman and McCurdy, 1980; Lundberg, 1985) or decrease it, suggesting in the second case that leisure for couples is often complementary (Hurd, 1990; Gustman and Steinmeier, 2000; Maestas, 2001). The empirical results are mixed. Berger (1983) argues that husbands' health problems increase the labor supply of wives, while McGeary (2009) finds that wives are likely to take early retirement to care for a sick spouse. However, Parsons (1977) and Coile (2004) show that the linkage between a husband's illness and his wife's labor supply is weak. For the impact on labor supply of poor health in wives, Berger (1983) finds a decrease in the labor supply of husbands, while Coile (2004) reports a small increase. A few empirical studies also find that the direction of spousal labor supply varies depending on various other conditions such as whether the affected spouse retires due to the health problems, whether a couple has access to health insurance or retirement benefits, etc. (McClenn, 1998; Coile, 2004).

South Korea (henceforth Korea) is an interesting case to study for several reasons. Korea is experiencing a rapid aging of its population without well-developed old-age security. The elderly in Korea compared with other developed countries tend to depend on their labor income rather than public transfers (OECD, 2013). Moreover, in Korea, the share of out-of-pocket payments in total health expenditure was 36.8 percent in 2015, which is a lot higher than the OECD average of 21.3 percent, although Korea has a universal public health insurance system, the National Health Insurance (OECD, 2017). This high share is because there is a ceiling on reimbursement

and some types of medical costs such as drugs, nursing home stays, and other related costs are not covered completely. Thus, if middle-to-old age workers experience negative health events but are ineligible for a public pension and lack savings, they may have difficulty maintaining a decent quality of life in their old age. In these cases, an increase in spousal labor supply may be observed in response to health problems, and its magnitude may depend heavily on the level of household assets. In addition, whether adult children reside with their parents can affect spousal labor supply decisions if adult children can also serve as caregivers for sick parents.

This study utilizes health shocks as the measurement of health status.[20] Using health shocks has an advantage over self-reported health status in this study, as health shocks are less likely to be subject to endogeneity issues. This study employs labor force entry and labor force exit as measures for labor supply decisions in order to assess the overall impact of health shocks. In addition, this study focuses on how labor supply responses to health shocks depend on the level of household assets. Moreover, the availability of adult children to participate in care-giving is also considered as factors that affect a sick person's and spousal labor supply.

This study presents several findings. Health shocks reduce the labor supply of the sick person for both males and females, which is consistent with the earlier studies. The study finds that a husband's health shock tends to decrease the probability of an exit from the labor force for the wife, depending on the type of shock. However, the significant impact of a woman's health shock on her husband's labor supply is not found. This negligible impact may reflect the fact that women's earnings are usually a secondary source of household income for dual-earner couples, so that male workers may not be very sensitive to the economic impact of their wives' health

[20] To the best of my knowledge, Coile (2004), McGeary (2009) and Ham (2016) are the only studies which utilize health shocks to examine the impact of health problems on spousal labor supply.

shocks. This study also finds that co-residing adult children tend to decrease the probability of a wife's exit from the labor force in response to a husband's health shock. Lower net household assets decrease the probability of exit from the labor force for males and increase the probability of entry into the labor force for females in response to their spouse's health shocks. This study extends the literature on the relationship between health shocks and labor supply in a household by investigating factors related to the labor supply response, such as care-giving behavior, household wealth, and presence of co-residing adult children.

The remainder of the paper is organized as follows. The next section reviews previous literature. Section 3.3 discusses the data used and the empirical strategy. Section 3.4 shows results and Section 3.5 summarizes and concludes.

3.2 Literature Reviews

3.2.1 Health and Individual Labor Supply

The starting point of this study is to explore how health status affects an individual's labor supply, which has been examined by extensive previous studies. In the literature of health economics, a negative health change means a depreciation in health stock or negative investment in health (Becker, 1964; Grossman, 1972). The deterioration of health affects an individual's labor supply through various mechanisms (McClellan, 1998). First, it can have a direct impact on an individual's productivity and results in labor supply changes in either direction, depending on the magnitude of the substitution and income effects of the following the reduction in wages. Second, negative health events can have an impact on labor supply by either reducing or increasing the marginal utility of income. For instance, if the affected individual cannot enjoy

relatively high-priced activities such as an overseas trip or eating out due to health problems, then the marginal utility of income decreases and it results in a reduction in labor supply. By contrast, if the adverse health events substantially increase demand for medications or nursing, then the marginal utility of income increases and this causes an increase in labor supply. By these measures, the impact of health on labor supply is ambiguous.

Though the impact of health status on labor supply has been studied extensively from an empirical perspective, it is not simple to accurately determine this relationship properly due to several methodological problems. First, as many studies point out, in studying the linkage between health and labor outcomes, health may not be given exogenously. The current stock of health depends on past investments in health, determined by an individual's lifetime utility maximization process, and thus is not determined exogenously (Becker, 1964; Grossman, 1972). Also, some studies find that health and socioeconomic status are simultaneously determined, mutually affecting each other (Smith and Kington, 1997; Smith 1999). Currie and Madrian (1999) suggest that labor market activities affect individuals' health by directly influencing the possibility of workplace injury, stress, and risk-taking behavior. These imply that health itself should often be treated as an endogenous variable. Thus, identification strategies in studying the consequences for labor supply of health problems need to be employed differently, according to health measures used. The second issue is the measurement of health. Empirical results regarding the impact of health on labor supply tend to differ depending on the measures used (Currie and Madrian, 1999). One common measure used in the literature is self-reported health status or health limitations on the ability to work. While this measure is more directly related to productivity and shows a significant relationship between health and labor supply in many studies, it is subject to measurement error and endogeneity concerns because it depends on an

individual's subjective judgments and may not be independent of labor market outcomes. Other measurements such as problems with activities of daily living (ADLs), nutritional status (e.g., height or weight) are often utilized, but these variables are not likely to be directly associated with the ability to work.

3.2.2 Health and Spousal Labor Supply

A sick worker may not be the only person whose labor supply decision is affected by his/her poor health condition. The labor supply of the spouse of that worker can also be affected since the labor supply decision in a household is often made jointly between a husband and wife, rather than separately (Ehrenberg and Smith, 2016). Theories regarding labor supply decisions in middle-to-old aged couples have been discussed primarily in retirement literature. The first theoretical channel of spousal response to health shocks is the "Added Worker Effect (AWE)." The AWE indicates that negative health shocks which cause a loss of lifetime household income increase spousal labor supply, assuming that leisure is a normal good (Ashenfelter, 1980; Heckman and McCurdy, 1980; Lundberg, 1985). Moreover, if there is substitution in home production between husband and wife, the increased time at home of the spouse who experiences health problems may lower the opportunity cost of work in the market for the other partner. This can result in enhancing the AWE. Another possible reason for an increase in spousal labor supply as a response to health problems is in case that a family is under liquidity constraints (Coile, 2004). A household may frequently face liquidity constraints if they don't have adequate accumulated savings to maintain consumption levels, or have not reached the age of eligibility for a pension.

By contrast, there are several reasons why negative health events might not increase spousal labor supply. First, leisure for husbands and wives can be complementary rather than substitutive as many studies indicate (Hurd, 1990; Maestas, 2001; Gustman and Steinmeier, 2000; Coile, 2004). This complementarity in married couples leads workers to decrease labor supply in response to the health-related retirement of a spouse. Second, if a disabling illness raises the need for care-giving for an affected spouse, this effect likely increases the healthy spouse's household production and, thus, decreases the value of his/her labor supply (McGreary, 2009). It may be more substantial when the spouse is the only caregiver in family. Third, alternative financial sources such as employer-provided health insurance or government benefits can crowd out the spousal labor supply response (Coile, 2004). As a result, the direction in the labor supply of workers response to health shocks endured by a spouse is theoretically ambiguous depending on the importance of these factors in household. On the other hand, McGeary (2009) suggests some empirical reasons why the effects of spousal health shocks may appear insignificant. First, all health shocks do not always have permanent effects. If this is the case, the change in the labor supply may not be observed in the data if an individual returns to work before the next wave's interview although the respondent reduces the labor supply temporarily. Another reason could be that if health shocks are not severe enough to force a worker to exit the labor force, then significant consequence may not be observed.

There are some empirical studies that estimate the effect of health problems on spousal labor supply. Parsons (1977) observes that husband's illnesses have little impact on the labor supply of wife using self-reported health status as a control variable in the National Longitudinal Surveys. He interprets that the income effect which increases the labor supply of wife may be offset by the need to spend more time in home production to look after the sick spouse. He also uses an

activity-limiting health condition as the measurement of health status in the Productive Americans Survey which was carried out in 1965. The results demonstrate that men increase home production time and women increase market work time in response to spousal illness by decreasing their leisure time. Berger (1983) studies how household work is affected when a husband or wife suffers a deterioration in health. Health deterioration in this analysis is represented by the variables indexing temporary illness, disability, and death in the 1978 Current Population Survey (CPS)-March supplement. The author finds that when their spouse's health is poor, a woman tends to increase labor supply, but a man decreases labor supply. McClellan (1998) also estimates husbands' health events on females' labor supply using the first two waves of the Health and Retirement Study (HRS) which was launched in 1992. The author argues that women work significantly fewer hours if their spouses experience major negative health events and subsequently retire. By contrast, the results find that women tend to increase working hours if their husbands have major negative health events but do not retire. However, this study mainly focuses on the individual's health events, so the impact of spousal health is not precisely reported.

A study by Coile (2004) uses the first six waves of the HRS to analyze the effect of health shocks on the labor supply of both spouses. The results show that spousal health shocks cause only a small increase in the labor supply for men and no significant increase for women. However, women tend to decrease labor supply when their husband's health shock is severe. This study also employs interactions of health shocks with other characteristics, including access to health insurance and retirement benefits such as Social Security or private pensions. In fact,

health insurance and labor supply are strongly linked in the U.S.[21] The author finds that for men, the probability of exit from the labor force is greater when their wife has retiree health insurance and has a health shock. For women, a husband's retiree health insurance has little effect. Neither effect, however, is significant. In the case of access to pensions, the results show that the probability of a husband's exit from the labor force is greater when a sick wife is pension-eligible. McGeary (2009) also investigates how retirement decisions are affected by health shocks of the other partner in a couple, using eight waves of the HRS (1992-2006). The author finds that a wife is more likely to retire to look after a sick spouse, and suggests that these results arise since women generally have smaller social security benefits than men. Ham (2016) also examines the effect of older adults' health shocks on their spouse's labor supply by using the five waves of the Korean Longitudinal Study of Aging. The results indicate that spouse's health shocks tend to positively affect exit from the labor force for women, while no effect is observed for men.

3.3 Data and Empirical Strategy

This study uses the five waves of the Korean Longitudinal Study of Aging (KLoSA), 2006-2014 to explore the effect of health shocks on the labor supply of married couples. The KLoSA began in 2006. It interviews individuals who were aged 45 or older in 2006 every two years[22]. It includes detailed information on both health and economic behavior such as demographics, family, health, employment, income, assets, and so forth. One important aspect of the KLoSA is

[21] Health insurance in the U.S. is provided primarily by the employer. There is a voluminous literature arguing that health insurance has a significant effect on labor market outcomes in the U.S.

[22] The number of samples in 2006 was 10,254.

that it contains detailed information on spousal health. The sample in this study includes married individuals who are between 45 and 70 years old, were working during the previous wave, whose spouse was working during the previous wave, and who were interviewed for at least two consecutive waves. The final sample consists of 4,711 individual-wave observations (2,257 males and 2,454 females).

To mitigate endogeneity concerns, several studies employ health shocks as a measure, rather than self-reported health status, in studying the effect of health on economic behaviors (McClellan, 1998; Smith, 1998; Smith, 1999; Riphahn, 1999; Wu, 2003; Coile, 2004; Wagstaff, 2007; Lee and Kim, 2008; McGeary, 2009; Ham, 2016). Basically, health shocks are defined as sudden deteriorations in an individual's health as a result of disease or accident (Riphahn, 1999). Mostly following Coile (2004) and McClellan (1998), this study also utilizes health shocks as a key independent variable, categorized into three types: (1) acute health events (heart attack, stroke, and cancer); (2) new chronic illnesses (diabetes, lung disease, heart failure, and arthritis); (3) accidental injuries or falls. McClellan (1998) suggests that these three types of health shocks may result in different consequences due to their heterogeneity in the extent to which health shocks lead to severe functional impairments and in the chronicity of health deterioration. For example, acute health events tend to have major acute and long-term functional implications; new chronic illnesses are less likely to affect functional status but may have long-term implications; accidents may result in temporary or permanent acute functional impairments. To extract the effects of new health shocks properly, this paper additionally controls for other health-related variables; dummies for whether the respondent has already suffered an acute or chronic disease; the self-reported index[23] of limitations on the ability to work, which includes

[23] This index ranges from 1(most severe) to 4 (not at all severe).

both the value of the previous wave and change in the value over two waves. The baseline regression equation is the linear probability model[24] as follows:

$$EXIT_{it} = \beta_0 + \beta_1 ownshock_{it} + \beta_2 spshock_{it} + \beta_3 X_{it}^{own} + \beta_4 X_{it}^{sp} + \varepsilon_{it}, \qquad (3.1)$$

where $EXIT_{it}$ is a dummy variable for whether an individual *i* who was working at period t-1 exits from the labor market at period t; $ownshock_{it}$ and $spshock_{it}$ are dummy variables for whether a worker and his/her spouse have experienced a new health shock since t-1; X_{it}^{own} is a set of demographic and economic control variables including age, education, place of residence, employment status (t-1), existing conditions for acute and chronic disease, limitations on the ability to work (t-1, index), change in limitations on the ability to work over a two-year period and net assets in household; X_{it}^{sp} is a set of spousal characteristics including age, education, employment status (t-1), existing condition for acute and chronic disease (t-1, index), limitations on the ability to work (t-1), and a change in limitations on the ability to work over a two-year period. Dummy variables for each wave are also included. This equation is estimated separately for male and female workers.

Table 3.1 shows the summary statistics. Over a two-year period, 7.7 percent of male workers exit the labor force while the comparable figure is 15.6 percent for female workers. In these two years, 2.7 percent of male workers undergo an acute health event, 2.9 percent are diagnosed with a new chronic illness, 1.6 percent are injured in an accident, and thus 6.8 percent of men have at least one of these new health shocks. 5.8 percent of male workers have already suffered an acute disease, and 17.0 percent have had a chronic illness. The sample statistics for

[24] The probit models as alternative specifications yield qualitatively similar results, and hence are not reported.

Table 3.1. Summary Statistics: Labor Force Exit

	Male		Female	
	Mean	S.D.	Mean	S.D.
Exited labor force	0.077	0.266	0.156	0.363
Any new health shocks	0.068	0.252	0.077	0.267
Acute health event	0.027	0.160	0.020	0.140
Chronic illness	0.029	0.169	0.036	0.187
Accident	0.016	0.123	0.026	0.161
Existing acute condition (1=yes)	0.058	0.231	0.046	0.209
Existing chronic condition (1=yes)	0.170	0.376	0.212	0.409
Initial health status (1→4, bad→good)	3.182	0.692	3.078	0.721
Change in health status	-0.095	0.791	-0.053	0.786
Age	58.88	5.681	56.53	5.874
Education (1=high school or more)	0.597	0.491	0.413	0.492
Employment status (t-1, 1=self-employed)	0.610	0.485	0.577	0.494
Place of residence (1=rural)	0.314	0.465	0.345	0.476
Household net assets (median, USD) [a]	149,990		147,010	
Obs.	2,257		2,454	

Note: Calculated by the author using the KLoSA data.
[a] It is assumed that 1,000 Korean Won is equal to 1 US dollar. The values are measured in 2008 USD.

the females' health shocks are relatively similar to those for males' health shocks. Male workers in the sample are, on average, around two years older than female workers. The median value of household net assets is about $150,000 (in 2008 USD) for both males and females.

Table 3.2 describes the characteristics of three health shocks in terms of their consequences. In the data set, 35.8 percent of people who suffer an acute health event exit the

labor force and 21.0 percent of individuals who are injured in accidents leave the labor market while 18.7 percent of people who are diagnosed with a new chronic illness leave the workforce, showing the lowest probability of exit from the labor force exit among three types of health shocks. Individuals who experience no health shock have a probability of exiting the work force of 10.9 percent. It seems clear that an individual's experience of health shocks increases the probability of exit from the labor force. Consistently, an acute health event is accompanied by the highest probability of a limitation in daily activities (48.6 percent); a chronic illness has the lowest impact on loss of function (30.6 percent). Also, an acute health event tends to lead to a more significant decrease in annual earned income than any other type of health shock. Accordingly, an acute health event results in the most severe impact on labor supply, physical function and earned income among the three health shock categories, as expected. By contrast, chronic illness has a relatively mild impact.

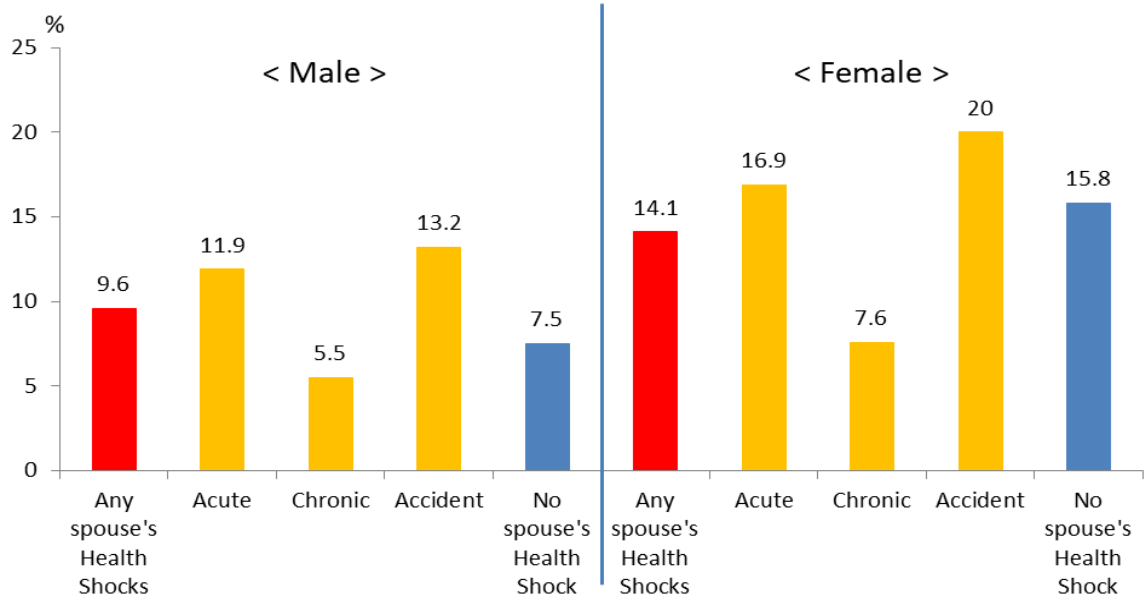
Table 3.2. Labor Supply, Limitation in Daily Activities and Income by Health Shocks

	Acute health event	Chronic illness	Accident	No health shock
Share of individuals who exit the labor force (%)	35.8	18.7	21.0	10.9
Share of ones with limitation in daily activities (%)	48.6	31.0	41.0	NA
Change in annual earned income (USD) [a]	-5,318	-3,226	-2,775	-2,497

Note: Calculated by the author using the KLoSA data.
[a] It is assumed that 1,000 Korean Won is equal to 1 US dollar. The values are measured in 2008 USD. Unpaid family workers are excluded in the calculation.

Figure 3.1 shows the probability of exit from the labor force exit by spousal health shocks in the raw data. For male workers, the exit probability is higher when a wife suffers an acute health event or an accident than when there is no health shock. However, the impact of a wife's chronic illness on exit from the labor force seems not to be much different from when there is no health shock. On the contrary, for female workers, a chronic illness is likely to lead to a substantially lower exit probability (7.6 percent) compared to other types of health shocks (acute health event: 16.9 percent; accident: 20.0 percent) or no health shock (15.8 percent), implying that a husband's chronic illness causes an AWE for wives.

Figure 3.1. Probability of Labor Force Exit by Spouse's Health Shocks



Note: Calculated by the author using the KLoSA data.

3.4 Results

3.4.1 Basic Results

Impact of Health Shocks on the Individual

The basic results for the linear probability model estimates based on equation (3.1) are presented in Table 3.3. The positive effects of health shocks on labor force exit are observed for both males and females. The effects are more substantial for male workers. An acute health event for men is estimated to lead to a 27.5 percentage point increase in the probability of exit from the labor force, and an accident for men raises the probability of exit by 12.8 percentage points. These effects are statistically significant and very large relative to the average probabilities of exit of 7.7 percent. The impact of a chronic illness is, however, relatively small and not significant. Accordingly, any health shocks for male workers raise the probability of labor force exit by 13.8 percentage points. For female workers, an acute health event elicits a 9.7 percentage point increase in labor force exit: this effect is marginally significant (*p*-value: 0.117). Female overall health shocks increase the probability of leaving the labor force by 5.6 percentage points and this effect is statistically significant at the 10 percent level. These results imply that the substitution effect of (potentially) reduced wages due to health shocks dominates the income effect.

Impact of Spousal Health Shocks

Table 3.3 also reports the effect of spousal health shocks on the probability of exit from the labor force. For male workers, any type of deteriorating spousal health does not statistically significantly affect the probability of exit. However, for working women, a husband's chronic illness lowers their probability of labor force exit by 9.2 percentage points as predicted by the AWE hypothesis, while neither a husband's acute health event nor an accident has a significant effect. These results raise two questions: (1) Why is the AWE for male workers not observed in response to spousal health shocks, and (2) Why is the AWE for female workers substantial in response only to chronic illness among the three types of husband's health shocks? These two

Table 3.3. Effects of Health Shocks on Labor Force Exit (0=Working, 1=Exit)

	Male		Female	
	(1)	(2)	(3)	(4)
Spouse's any health shocks	0.015		-0.030	
	(0.025)		(0.026)	
Acute health event		0.045		0.006
		(0.053)		(0.044)
Chronic illness		-0.032		-0.092***
		(0.028)		(0.031)
Accident		0.052		0.030
		(0.044)		(0.061)
Own any health shocks	0.138***		0.056*	
	(0.032)		(0.030)	
Acute health event		0.275***		0.097†
		(0.061)		(0.062)
Chronic illness		0.038		0.039
		(0.039)		(0.044)
Accident		0.128*		-0.003
		(0.067)		(0.047)
Existing condition (acute, 1=yes)	0.042†	0.043†	-0.001	0.001
	(0.026)	(0.026)	(0.038)	(0.038)
Existing condition (chronic, 1=yes)	0.034*	0.029†	-0.017	-0.017
	(0.018)	(0.018)	(0.022)	(0.021)
Initial health status (1→4, bad→good)	-0.065***	-0.060***	-0.056***	-0.057***
	(0.012)	(0.011)	(0.016)	(0.015)
Change in health status	-0.065***	-0.058***	-0.053***	-0.053***
	(0.011)	(0.012)	(0.013)	(0.013)
Age	0.008***	0.008***	0.005*	0.004†
	(0.002)	(0.002)	(0.003)	(0.003)
Education (1=high school or more)	0.046***	0.042***	-0.009	-0.009
	(0.016)	(0.015)	(0.023)	(0.023)
Employment status (1=self-employed)	-0.062***	-0.061***	-0.046**	-0.047**
	(0.014)	(0.013)	(0.019)	(0.019)
Residence (1=rural)	-0.031**	-0.032**	-0.074***	-0.074***
	(0.013)	(0.013)	(0.018)	(0.018)
Spouse's other variables [a]	Yes	Yes	Yes	Yes
Adj. R-sq.	0.106	0.122	0.044	0.046
Obs.	2,257	2,257	2,454	2,454

Notes: Robust standard errors in parentheses. †, *, **, and *** indicate statistical significance at the 15, 10, 5, and 1 percent level, respectively. All regressions include logged household net assets dummies for waves. Standard errors are corrected for repeated observations on same individuals.

[a] Age, education, employment status, existing conditions for acute and chronic disease, initial health status, and change in health status.

questions can be answered by examining the magnitude of income loss and the care-giving needs caused by spousal health shocks.

The AWE for males can be offset if a wife's health shocks trigger substantial care-giving needs. However, as can be seen in Table 3.4, only 1.6% of female workers who have new health shocks receive care-giving from a husband although these health shocks are limiting to their daily activities[25]. Another explanation for this little impact on male workers could be that the earnings of women are usually smaller than those of men and often a secondary income source in dual-earner couples in Korea. Therefore, male workers may not be sensitive to the economic impact of female's health shocks, resulting in little male workers' AWE. Table 3.4 provides the supportive statistics. In the samples, the average annual earned income at the previous period (t-1) was $22,932 (in 2008 USD) for male workers, which is more than double of female workers' annual earnings (USD 9,824).

Table 3.4. Annual Earned Income by Gender and Share of Individuals Receiving Care-giving from the Spouse by Gender and Heath Shocks

	(1) Male	(2) Female
Average annual earned income (t-1, USD)[a]	22,932	9,824
Share of individuals receiving care from the spouse (%)	18.1	1.6
Acute health event (%)[b]	30.6	0
Chronic illness (%)[b]	4.4	0
Accident (%)[b]	13.3	4.0

Note: Calculated by the author using the KLoSA data.
[a] It is assumed that 1,000 Korean Won is equal to 1 US dollar. The values are measured in 2008 USD.
[b] These health shocks are limiting daily activities of individual.

[25] In Korea, the smaller amount of care-giving by males for their wives may arise because it is difficult for male workers to stop work due to it often being the primary source of income ; or perhaps because men are not as good as women at care-giving.

The AWE for female workers can be more significant in cases of husbands' chronic illness if a chronic illness requires less need for a wife's care, or results in longer-term medical expenditures. Table 3.4 shows that only 4.4 percent of husbands who are diagnosed with a chronic illness receive care-giving from their wife while an acute health event and an accident cause 30.6 percent and 13.3 percent, respectively.[26] The relatively smaller need to care for husbands with chronic illness can lead to strengthening the AWE for women.

3.4.2 Severity of Health Shocks

Workers' labor supply response to health shocks may vary depending on the severity of the shocks because more severe health shocks can lead to higher income loss or require more assistance with daily activities. However, health shock measures in the KLoSA do not allow differentiating between moderate and severe health deterioration directly. Thus, to test the role of severity, this study utilizes the KLoSA's question about whether a health shock limits a respondent's daily activities as a proxy for severity. The health shock is regarded as "Severe" if it limits daily activities. Table 3.5 reports the regression results of equation (3.1) where the health shock variables are classified into two different categories based on their severity. This method compares each worker's group, ("severe" and "not severe") with the reference group of individuals without related health shock. As might be expected, overall severe health shocks are associated with an increase of 24.6 percentage points for male workers and 13.0 percentage points for female workers in the probability of labor force exit compared to individuals without health shocks. These effects are strongest in terms of magnitude and significance in cases of an acute health shock. The impacts of "not severe" health shocks are marginally significant at the 15

[26] In spite of its importance in explaining the empirical results, medical expenditures which are related to health shocks cannot be identified in this study due to data limitation.

Table 3.5. Effects of Health Shocks on Labor Force Exit by Severity (0=Working, 1=Exit,)

	Male		Female	
	(1)	(2)	(3)	(4)
Spouse's health shocks				
Any & Not severe	0.030		-0.060*	
	(0.029)		(0.032)	
Any & Severe	-0.017		-0.001	
	(0.039)		(0.041)	
Acute & Not severe		0.019		-0.029
		(0.064)		(0.068)
Acute & Severe		0.081		0.027
		(0.097)		(0.057)
Chronic & Not severe		-0.011		-0.062†
		(0.034)		(0.041)
Chronic & Severe		-0.085***		-0.154***
		(0.021)		(0.043)
Accident & Not severe		0.094†		-0.040
		(0.059)		(0.069)
Accident & Severe		-0.013		0.114
		(0.053)		(0.096)
Own health shocks				
Any & Not severe	0.054†		0.019	
	(0.037)		(0.035)	
Any & Severe	0.246***		0.130**	
	(0.053)		(0.057)	
Acute & Not severe		0.178**		0.025
		(0.086)		(0.066)
Acute & Severe		0.334***		0.265**
		(0.080)		(0.122)
Chronic & Not severe		0.006		0.034
		(0.042)		(0.051)
Chronic & Severe		0.098		0.071
		(0.075)		(0.085)
Accident & Not severe		0.057		-0.062
		(0.076)		(0.054)
Accident & Severe		0.228**		0.092
		(0.113)		(0.082)
Adj. R-sq.	0.115	0.128	0.046	0.050
Obs.	2,257	2,257	2,454	2,454

Notes: Robust standard errors in parentheses. †, *, **, and *** indicate statistical significance at the 15, 10, 5, and 1 percent level, respectively. All regressions include dummies for education, employment status, residence, existing conditions for acute and chronic disease and waves, age, logged household net assets, and spouse's other variables. Standard errors are corrected for repeated observations on same individuals.

percent level for males and are not significant for females.

As shown in Column (3) of Table 3.5, female workers' probability of exit from the labor force decreases by 6.0 percentage points in response to husbands' health shocks overall which are "not severe". These AWEs are observed in all three types of men's "not severe" health shocks although they are not statistically significant at the 10 percent level. One of the possible explanations for these results can be found in a difference in care-giving needs by the severity of health shocks. In the samples, 18.1 percent of the husbands with severe heath shocks received care-giving from their wives, while 3.7 percent of the husbands with "not severe" health themselves so much about caring for an ailing husband. Interestingly, a spouse's severe chronic illness significantly leads to an AWE for both males and females. These results might result from the fact that a chronic illness requires less spousal care even if it is severe, compared to other types of health shocks. Another possible reason for these results is that a severe chronic illness results in greater medical costs due to its long-term effects, and this therefore enhances the AWE. As described by Heckman and McCurdy (1980), the AWE tends to be more substantial if the income loss is larger.

3.4.3 Presence of Adult Children in Household

Another important factor in labor supply response to health shocks may be living arrangements. In particular, the presence of adult children in a household may have a critical impact on labor supply decisions since adult children can be an alternative caregiver for the sick worker. Therefore, this study investigates the effect of adult children on labor supply response to health shocks by having the dummy variables for health shocks interact with a dummy for whether respondents live with their adult children.

Table 3.6. Effects of Co-residence with Adult Children on Labor Force Exit

	Male		Female	
	(1)	(2)	(3)	(4)
Spouse's any health shocks	0.040		-0.086*	
× Co-residence with adult children	(0.048)		(0.049)	
Sp_Acute		0.051		-0.095
× Co-residence with adult children		(0.106)		(0.084)
Sp_Chronic		0.016		0.007
× Co-residence with adult children		(0.057)		(0.058)
Sp_Accident		0.065		-0.205**
× Co-residence with adult children		(0.086)		(0.101)
Spouse's any health shocks	-0.002		0.007	
	(0.033)		(0.038)	
Sp_Acute health event		0.023		0.053
		(0.071)		(0.067)
Sp_Chronic illness		-0.040		-0.092**
		(0.037)		(0.042)
Sp_Accident		0.016		0.092
		(0.059)		(0.084)
Own any health shocks	0.070		0.032	
× Co-residence with adult children	(0.065)		(0.060)	
Acute × Co-residence with adult children		0.053		-0.213*
		(0.120)		(0.117)
Chronic × Co-residence with adult children		0.015		0.104
		(0.076)		(0.088)
Accident × Co-residence with adult children		0.000		0.103
		(0.132)		(0.093)
Own any health shocks	0.106**		0.041	
	(0.043)		(0.041)	
Acute health event		0.242***		0.176*
		(0.093)		(0.086)
Chronic illness		0.032		-0.009
		(0.052)		(0.055)
Accident		0.133		-0.052
		(0.095)		(0.060)
Co-residence with adult children (1=yes)	-0.105	-0.011	-0.017	-0.018
	(0.012)	(0.012)	(0.017)	(0.017)
Adj. R-sq.	0.107	0.123	0.045	0.051
Obs.	2,257	2,257	2,454	2,454

Notes: Robust standard errors in parentheses. †, *, **, and *** indicate statistical significance at the 15, 10, 5, and 1 percent level, respectively. All regressions include dummies for education, employment status, residence, existing conditions for acute and chronic disease and waves, age, logged household net assets, and spouse's other variables. Standard errors are corrected for repeated observations on same individuals.

As can be seen in Table 3.6, the results find that co-residence with adult children lowers the probability of exit from the labor force exit for women by 8.6 percentage points in response to a husband's new health shocks. The sign of coefficients for interaction terms for an acute health event and an accident are negative for women. Given that women more often provide care-giving to a spouse who has had new health shocks than men do, especially in cases of an acute health event or an accident (as shown in Table 3.4), these negative signs of coefficients are consistent with expectations. These results imply that adult children may substitute for a mother in care-giving for a father. Specifically, in response to a husband's accident, female workers who live with adult children tend to have a probability of exit lower by 20.5 percentage points than female workers without adult children in the household.

3.4.4 Household Net Assets

An individual who has a sick spouse may rely more on savings or borrowing instead of adjusting labor supply, if a family has sufficient wealth or is able to access capital markets easily (i.e., no liquidity constraint). Coile (2004) argues that if a household is facing liquidity constraints, this enhances the likelihood of an increase in labor supply as a response to spousal health problems.[27] This point may be particularly noticeable in Korea since many older Koreans were not able to accumulate great wealth due mainly to the high cost of raising children, and limitations on eligibility for public pensions. This study examines whether the level of household net assets affects the labor supply response to spousal health shocks. One way to explore this is to provide a continuous variable for the level of household net assets to interact with the health shocks. However, this method of analysis may be problematic because health shocks can affect the level

[27] In fact, the level of household assets and the degree of liquidity are closely related. Some studies (Juster and Shay, 1964; Zeldes, 1989; Runkle, 1991) argue that low-wealth households are more likely to be liquidity-constrained, while high-wealth households have easier access to credit markets or no need to borrow.

of household net assets as well as labor supply simultaneously. In order to mitigate this problem, I use the dummy variable for the level of household net assets ("B_25") instead of the continuous variable. Note that the dummy variable "B_25" is one, if individuals are in the bottom 25 percent of household net assets distribution, and zero otherwise.

The results of this analysis are shown in Table 3.7. For males, the AWE is observed as indicating that workers in the bottom 25 percent have an exit probability of 13.7 percentage points lower in response to a wife's health shocks than workers in the top 75 percent. These effects are more substantial in the case of accident. However, comparable effects are not observed for female workers.

3.4.5 Impacts on Labor Force Entry

The previous subsections focus on the labor supply decisions of workers who were participating in the labor market during the previous wave. However, to assess the overall impact of health shocks on labor supply, the impact on labor force entry for non-workers also needs to be examined. To do it, this subsection analyses people who are 70 years old or younger, and who were not participating in the labor market during the previous wave. A total 6,593 individual-wave observations are collected (1,687 males and 4,906 females). The regression equation is as follows:

$$ENTRY_{it} = \beta_0 + \beta_1 ownshock_{it} + \beta_2 spshock_{it} + \beta_3 X_{it}^{own} + \beta_4 X_{it}^{sp} + \varepsilon_{it}, \qquad (3.2)$$

where $ENTRY_{it}$ is a dummy variable for whether individual *i* who was not in the labor force at period t-1 enters the labor market at period t; $ownshock_{it}$ and $spshock_{it}$ are defined as the same as those in equation (3.1); X_{it}^{own} is a set of an individual's characteristics including age,

Table 3.7. Effects of Health Shocks on Labor Force Exit by the Level of Household Net Assets (0=Working, 1=Exit)

	Male		Female	
	(1)	(2)	(3)	(4)
Spouse's any health shocks × B_25	-0.137***		-0.046	
	(0.038)		(0.063)	
Sp_Acute × B_25		-0.130†		-0.064
		(0.079)		(0.103)
Sp_Chronic × B_25		-0.054		0.030
		(0.047)		(0.074)
Sp_Accident × B_25		-0.206***		0.066
		(0.070)		(0.128)
Spouse's any health shocks	0.059*		-0.042	
	(0.034)		(0.029)	
Sp_Acute health event		0.075		0.018
		(0.070)		(0.050)
Sp_Chronic illness		-0.016		-0.105***
		(0.041)		(0.032)
Sp_Accident		0.123*		0.010
		(0.064)		(0.073)
Own any health shocks × B_25	0.033		-0.021	
	(0.072)		(0.065)	
Acute × B_25		-0.156		0.177
		(0.139)		(0.144)
Chronic × B_25		0.117		-0.049
		(0.096)		(0.095)
Accident × B_25		0.165		-0.082
		(0.131)		(0.093)
Own any health shocks	0.130***		0.061	
	(0.038)		(0.037)	
Acute health event		0.303***		0.048
		(0.069)		(0.070)
Chronic illness		0.003		0.050
		(0.039)		(0.053)
Accident		0.076		0.028
		(0.084)		(0.063)
B_25 (1=Bottom 25% of household net assets)	-0.011	-0.011	-0.003	0.000
	(0.014)	(0.014)	(0.022)	(0.017)
Adj. R-sq.	0.110	0.130	0.044	0.047
Obs.	2,257	2,257	2,454	2,454

Notes: Robust standard errors in parentheses. †, *, **, and *** indicate statistical significance at the 15, 10, 5, and 1 percent level, respectively. All regressions include dummies for education, employment status, residence, existing conditions for acute and chronic disease and waves, age, logged household net assets, and spouse's other variables. Standard errors are corrected for repeated observations on same individuals.

education, place of residence, existing conditions for acute and chronic disease, limitations on the ability to work (t-1, index), change in limitations on the ability to work over a two-year period and net assets in household; X_{it}^{sp} is a set of spousal characteristics including age, education, working status (t-1 and t), existing condition for acute and chronic disease (t-1), limitations on the ability to work (t-1), and a change in limitations on the ability to work over a two-year period. Dummy variables for each wave are also included

Table 3.8 reports the summary statistics of the samples. 17.2 percent of men who were economically inactive during the previous wave enter the labor market, and 12.0 percent of women start working. Around 10 percent of people experience new health shocks during a given period for both men and women, and their existing conditions for acute and chronic diseases are worse than those of workers who are analyzed in the previous subsections. Worse already-existing conditions are likely to be among the reasons why they left the labor market during the previous wave.

Table 3.9 shows the share of individuals receiving care-giving from a spouse when they suffered health shocks which limited daily activities. The statistics show that 30.6 percent of males and 14.1 of females receive care-giving from their spouse. Unlike the earlier analysis where samples are the workers who participated in the labor market during the previous wave, a small proportion of women receive care-giving from their husband. This difference between two analyses in the share of females receiving care likely arises from the fact that 45.1 percent of husbands in the female samples were not working during the previous period and, thus, husbands may be relatively free to care for their sick wives.

Table 3.8. Summary Statistics: Labor Force Entry

	Male		Female	
	Mean	S.D.	Mean	S.D
Entered labor force	0.172	0.377	0.120	0.326
Any new health shock	0.107	0.309	0.105	0.306
Acute health event	0.044	0.199	0.028	0.165
Chronic illness	0.041	0.202	0.057	0.232
Accident	0.027	0.161	0.027	0.163
Existing condition (acute, 1=yes)	0.202	0.401	0.116	0.320
Existing condition (chronic, 1=yes)	0.298	0.457	0.299	0.458
Initial health status (1→4, bad→good)	2.657	0.893	2.830	0.783
Change in health status	-0.002	0.819	-0.020	0.780
Age	64.43	4.610	60.07	6.335
Education (1=high school or more)	0.276	0.447	0.381	0.486
Spouse's working status (t, 1=working)	0.265	0.442	0.451	0.497
Spouse's working status (t-1, 1=working)	0.323	0.468	0.547	0.498
Place of residence (1=rural)	0.209	0.407	0.182	0.385
Household net assets (median, USD) [a]	151,181		162,000	
Obs.	1,687		4,906	

Note: Calculated by the author using the KLoSA data.
a It is assumed that 1,000 Korean Won is equal to 1 US dollar. The values are measured in 2008 USD.

Table 3.9. Share of Individuals Receiving Care-giving from the Spouse by Gender and Health Shocks

	Male	Female
Any health shocks (%)[b]	30.6	14.1
Acute health event (%)[b]	28.3	10.0
Chronic illness (%)[b]	34.3	15.6
Accident (%)[b]	30.0	13.9

Note: Calculated by the author using the KLoSA data.
[a] It is assumed that 1,000 Korean Won is equal to 1 US dollar. The values are measured in 2008 USD.
[b] These health shocks are limiting daily activities of individual.

Table 3.10 provides the regression results for equation (3.2). For males, no statistically significant effect of their own or their spouse's health shocks is observed. For females, however, an individual's acute health event causes a 6.6 percentage point decrease in the probability of labor force entry. Also, for women, the AWE follows spouse's health shocks. The husbands' overall health shocks increase the probability of entry into the work force by 2.6 percentage points, though this is marginally significant at the 15 percent level (*p*-value: 0.120). These results are consistent with the results of the previous analysis where the dependent variable is labor force exit. I also run regressions where the interaction terms with a dummy for the level of household assets ("B_25") and health shocks are included. As reported in Table 3.11, the results indicate that for males, no significant impact is observed. However, in response to a husband's health shocks, the probability of labor force entry of females who are in the bottom 25 percent of net asset holders is 11.8 percentage points higher than that of females in the top 75 percent. This suggests that lower household net assets strengthen the AWE of women. This AWE is more substantial in cases of a husband's acute health event.

Table 3.10. Effects of Health Shocks on Labor Force Entry (0=No Entry, 1=Entry)

	Male		Female	
	(1)	(2)	(3)	(4)
Spouse's any health shocks	0.009		0.026†	
	(0.028)		(0.017)	
Acute health event		0.009		0.014
		(0.051)		(0.023)
Chronic illness		0.019		0.025
		(0.038)		(0.024)
Accident		-0.022		0.052
		(0.049)		(0.038)
Own any health shocks	-0.000		-0.009	
	(0.027)		(0.014)	
Acute health event		-0.055		-0.066***
		(0.035)		(0.017)
Chronic illness		0.032		0.006
		(0.044)		(0.018)
Accident		0.004		0.026
		(0.047)		(0.028)
Existing acute condition (1=yes)	-0.037*	-0.039*	-0.017	-0.018
	(0.022)	(0.022)	(0.012)	(0.012)
Existing chronic condition (1=yes)	-0.020	-0.019	0.002	0.003
	(0.022)	(0.022)	(0.011)	(0.011)
Initial health status (1→4, bad→good)	0.080***	0.079***	0.048***	0.048***
	(0.013)	(0.013)	(0.009)	(0.009)
Change in health status	0.061***	0.060***	0.035***	0.034***
	(0.013)	(0.013)	(0.007)	(0.007)
Age	-0.019***	-0.019***	-0.005***	-0.005***
	(0.004)	(0.004)	(0.002)	(0.002)
Education (1=high school or more)	-0.024	-0.020	-0.030**	-0.029**
	(0.027)	(0.024)	(0.013)	(0.014)
Place of residence (1=rural)	0.019	0.020	0.111***	0.111***
	(0.024)	(0.024)	(0.015)	(0.015)
Spouse's other variables [a]	Yes	Yes	Yes	Yes
Adj. R-sq.	0.098	0.099	0.073	0.074
Obs.	1,687	1,687	4,906	4,906

Notes: Robust standard errors in parentheses. †, *, **, and *** indicate statistical significance at the 15, 10, 5, and 1 percent level, respectively. All regressions include a dummy for waves. Standard errors are corrected for repeated observations on same individuals.

[a] Age, education, working status (t-1, t), existing conditions for acute and chronic disease, initial health status, and change in health status.

Table 3.11. Effects of Health Shocks on Labor Force Entry by the Level of Household Net Assets (0=No Entry, 1=Entry)

	Male		Female	
	(1)	(2)	(3)	(4)
Spouse's any health shocks × B_25	0.008		0.118***	
	(0.059)		(0.042)	
Sp_Acute × B_25		0.069		0.194***
		(0.113)		(0.061)
Sp_Chronic × B_25		-0.020		0.072
		(0.077)		(0.063)
Sp_Accident × B_25		0.013		0.068
		(0.099)		(0.078)
Spouse's any health shocks	0.007		-0.008	
	(0.034)		(0.017)	
Sp_Acute health event		-0.012		-0.042**
		(0.059)		(0.020)
Sp_Chronic illness		0.026		0.006
		(0.045)		(0.026)
Sp_Accident		-0.027		0.024
		(0.062)		(0.042)
Own any health shocks × B_25	-0.004		-0.022	
	(0.055)		(0.031)	
Acute × B_25		-0.007		-0.055†
		(0.077)		(0.034)
Chronic × B_25		-0.072		-0.036
		(0.086)		(0.040)
Accident × B_25		0.084		0.005
		(0.093)		(0.060)
Own any health shocks	-0.001		-0.002	
	(0.032)		(0.016)	
Acute health event		-0.055		-0.050**
		(0.041)		(0.021)
Chronic illness		0.046		0.018
		(0.052)		(0.022)
Accident		-0.026		0.022
		(0.060)		(0.031)
B_25 (1=Bottom 25% of household net assets)	-0.035	-0.036	0.016	0.015
	(0.027)	(0.027)	(0.015)	(0.015)
Adj. R-sq.	0.099	0.101	0.076	0.078
Obs.	1,687	1,687	4,906	4,906

Notes: Robust standard errors in parentheses. †, *, **, and *** indicate statistical significance at the 15, 10, 5, and 1 percent level, respectively. These specifications have fewer observations than the previous ones due to missing household net asset data. All regressions include dummies for education, residence, existing conditions for acute and chronic disease and waves, age, logged household net assets, and spouse's other variables. Standard errors are corrected for repeated observations on same individuals.

3.5 Conclusion

This paper investigates the impact of an individual's own and spousal health shocks on the labor supply in Korea. The study finds that health shocks lower the labor supply of both males and females, which is consistent with previous studies. The study reveals that husbands' chronic illnesses tend to increase wives' labor supply, as predicted by the AWE. One of the possible reasons why the AWE is observed in cases of husbands' chronic illnesses is that among three types of husbands' health shocks, chronic illness is less often followed by wives' care-giving, which may offset the AWE. The results also find that wives' health shocks have little impact on husbands' labor supply. This may result from the fact that women's earnings are usually less than men's earnings in dual-earner couples, so that male workers may not be sensitive to female's health shocks in terms of subsequent household income loss.

In addition, this study addresses the role of the presence of co-residing adult children and the level of household net assets in determining the impact of health shocks on labor supply of married couples. With respect to the role of the presence of adult children in the household, the results indicate that co-residence with adult children tends to decrease the probability of exit from the labor force exit for women if husbands experience health shocks. In these cases, co-residing adult children may substitute for a mother in care-giving for a father. The most important findings of the study are that lower net assets in a household reduce the probability of exit from the labor force exit for males and raise the probability of entry into the labor force for females in response to their spousal health shocks. These results suggest that lack of sufficient savings or liquidity constraints enhance the AWE in Korea.

Given the current concerns about poverty among the elderly and a rapidly aging population in Korea, these findings produce two important implications. First, the Korean elderly tend to depend more on labor income than public transfers, compared with other developed countries. Therefore, if the elderly face negative health shocks with little chance of eligibility for a public pension or a lack of savings, they may have difficulty maintaining a decent quality of life in old age. Second, in response to spousal health shocks, an involuntary increase in labor supply of a spouse in lower-income groups may make a situation worse if working conditions are poor and thus increases likelihood of further health problems.

REFERENCES

Ashenfelter, O. (1980). Unemployment as disequilibrium in a model of aggregate labor supply. *Econometrica: Journal of the Econometric Society*, 547-564.

Becker, G. S. (1964). Human capital theory. *Columbia, New York*.

Berger, M. C. (1983). Labor supply and spouse's health: The effects of illness, disability, and mortality. *Social Science Quarterly*, *64*(3), 494.

Coile, C. C. (2004). Health shocks and couples' labor supply decisions (No. w10810). *National Bureau of Economic Research.*

Currie, J., & Madrian, B. C. (1999). Health, health insurance and the labor market. *Handbook of Labor Economics*, *3*, 3309-3416.

Ehrenberg, R. G., & Smith, R. S. (2016). *Modern labor economics: Theory and Public Policy*. Routledge.

Grossman, M. (1972). On the concept of health capital and the demand for health. *Journal of Political Economy*, *80*(2), 223-255.

Gustman, A. L., & Steinmeier, T. L. (2000). Retirement in dual-career families: a structural model. *Journal of Labor Economics*, *18*(3), 503-545.

Ham, S. (2016). The effect of health problems on old aged couples' labor supply in Korea. *Health and Social Welfare Review*, 36(4), 157-186.

Heckman, J. & McCurdy, T. (1980). A Life Cycle Model of Female Labour Supply." *Review of Economic Studies,* 47.

Hurd, M. D. (1990). The joint retirement decision of husbands and wives. *In Issues in the Economics of Aging* (pp. 231-258). University of Chicago Press.

Juster, F. T., & Shay, R. P. (1964). Consumer sensitivity to finance rates. In *Consumer Sensitivity to Finance Rates: An Empirical and Analytical Investigation* (pp. 6-46). NBER.

Lee, J., & Kim, H. (2008). A longitudinal analysis of the impact of health shocks on the wealth of elders. *Journal of Population Economics*, 21(1), 217-230.

Lundberg, S. (1985). The added worker effect. *Journal of Labor Economics*, *3*(1, Part 1), 11-37.

Maestas, N. (2001). Labor, Love, and Leisure: Complementarity and the Timing of Retirement by Working Couples, *mimeo, University of California at Berkeley*.